PHOTOGRAPHIC SOCIETIES.

PHOTOGRAPHIC SOCIETIES OF THE UNITED KINGDOM.

The following list of British Photographic Societies has been compiled from data supplied by their respective Secretaries, except where so indicated. In these instances no information has been received up to the time of going to press.

* Societies marked with an asterisk are affiliated to the Royal Photographic Society.

* The Royal Photographic Society of Great Britain.

FOUNDED 1853.

Patrons.—His Majesty the King; Her Majesty Queen Alexandra.

President.—Furley Lewis, F R.P S.

Vice-Presidents.—His Grace the Duke of Newcastle, C. Atkin Swan, M.B., B Ch (Oxon), M R C S., F R A S.

Past-Presidents.—Sir Charles Eastlake, P.R A , 1853 to 1855, Sir Frederick Pollock, Lord Chief Baron, 1855 to 1869; James Glaisher, F.R S , 1869 to 1874 and 1875 to 1892; John Spiller, F.I.C., F.C S , 1874 to 1875, Sir W de W Abney, K C B., 1892 to 1894, 1896, 1903, and 1904, Sir H. Trueman Wood, M A., 1894 to 1896; the Right Hon. the Earl of Crawford, K.T., F R S., 1897 to 1900; Thomas R Dallmeyer, F.R A S , 1900 to 1903; Major-General J. Waterhouse, I A., 1905 to 1907, J C S. Mummery, A.R I.B.A., Hon. Fellow, 1908-1910, the Right Hon. Lord Redesdale, G C.V.O., K C B , etc , 1910-1912, Chapman Jones, F.I.C., F.C.S., 1912-1914

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Meetings.—Held at 35, Russell Square, London, W C. Weekly on Tuesday evenings, from October to June inclusive

Secretary.—J. McIntosh, 35, Russell Square, London.

Aberdeen Photographic Association.—*Pres.*, Alfred J. Wood. *Meetings*, 154, Union Street, Tuesdays, 8 p.m. *Sec.* James Milne, 38, Elmfield Avenue, Aberdeen.

Aberdeen Photo. Art Club.—*Pres.*, John D. Stephen. *Meetings* 220, Union Street, Alternate Thursdays and Fridays, 8 p.m., from October 23 *Sec.*, John Rae, 19, St. Nicholas Street, Aberdeen.

Aberdeen Century Camera Club.—*Pres.*, Dr. Thomas Milne. *Meetings.*, Monthly, 8 p.m., from September 30. *Sec.*, J B. Philip, 8, Belvidere Crescent, Aberdeen.

Accrington Camera Club.—*Pres.*, The Mayor. *Meetings*, Market Chambers, Wednesdays, October to March; First Wednesdays, April to September, 7 45 p.m. *Sec.*, John Bonnard, 1, Turkey Street, Accrington

Accrington. Wesley Guild Camera Club.—*Pres.*, Geo. Blackledge. *Meetings*, Wesley School, Abbey Street. *Sec.*, W. E. Ellis, 36, Beech Street, Accrington.

***Acton Photographic Society.**—*Pres.*, A. H. C. Hughes. *Meetings*, Churchfield Hall, Second and Fourth Wednesdays, 8 p.m., October to April. *Sec.*, W. L. Wright, 19, Churchfield Road, East Acton, London, W.

Airdrie.—Monklands Photographic Society.—*Pres.*, J. W. Fordyce. *Meetings*, Studio, Victoria Place, Tuesdays, 8 p.m. *Sec.*, W. B. Hossack, Deveron Bank, Airdrie.

Armley and Wortley Photographic Society.—*Pres.*, Dr. T. H. Waddington. *Meetings*, Men's Institute, Ridge Road, Armley, Thursdays, 8 p.m. *Sec.* H. Storey, 10, Edinburgh Terrace, Armley, Leeds

***Ashbourne Photographic Society.**—*Pres.*, Rev. A. Gamble. *Meetings*, Albion House, St. John's Street, Third Mondays, 7 30 p.m. *Sec.*, J. A. Salmon, Green Road, Ashbourne.

Ashford.—Spelthorne Camera Club.—*Pres.*, Rev. A. Thornton, M.A., LL.D. *Meetings*, National Schools, Thursdays, 8 p.m. *Sec.*, Cyril M. Neaves, School House, Ashford, Middlesex.

Ashton-under-Lyne Photographic Society.—*Pres.*, John W. Kenworthy, J.P. *Meetings*, Old Square, Thursdays, 8 p.m. *Sec.*, T. F. Kershaw, Glyn Isa, Smallshaw, Ashton-under-Lyne.

Aston Photographic Society.—*Pres.*, Harold Baker. *Meetings*, Burlington Hall, High Street, Thursdays, 8 p.m. *Sec.*, R. J. Cooper, 86, Witton Road, Aston, Birmingham.

Ayr Amateur Photographic Society.—*Pres.*, David Meikle *Meetings*, 16, New Bridge Street, Mondays, 8 p.m. *Ex.*, February, *Sec.*, Arthur Turner, Brewery House, Ayr.

***Balham Camera Club.**—*Particulars not received from Secretary.*

Balham.—Cavendish Camera Club.—*Pres.*, Thomas W. Barber, *Meetings*, L.C.C. School, Fircroft Road, Alternate Wednesdays. 8 p.m. *Sec.*, B. Griffiths, 39, Narbonne Avenue, Clapham Common, London, S.W.

Banbury and District Photographic Society.—*Meetings*, Municipal Technical School, First Mondays, 8 p.m. *Sec.*, Seymour H. Beale, "Caerleon," Banbury.

Barnard Castle and District Amateur Photographic Society. —*Pres*., J. E. Dent. *Meetings*, Mason's Rooms, Fridays, 7.30 p.m. *Sec.*, E. Holdsworth, 3, Wilson Street, Barnard Castle.

Barrhead Art Club.—*Pres.*, Rev. Thomas Cook, M.A. *Meetings*, Studio, Water Road, First and Third Wednesdays, 8 p.m. *Sec.*, Robert Colquhoun, 4, Mill Road, Barrhead.

***Barrow Naturalists' Field Club (Photographic Section).**—*Pres.*, James Frankland. *Meetings*, Cambridge Hall, St. George's Square, Tuesdays, 8.15 p.m. *Sec.*, R. B. Domony, 190, Park Avenue, Barrow-in-Furness.

Barry Y.M.C.A. Camera Club.—*Pres.*, Maj.-Gen. H. H. Lee. *Meetings*, Y.M.C.A., Fridays, 7.30 p.m. *Ex.*, March. *Sec.*, A. C. White, 26, Canon Street, Barry, Glamorganshire.

***Bath Photographic Society.**—*Pres.*, Rev. Jas. Dunn, M.A. *Meetings*, Royal Institution, Alternate Mondays, 8 p.m., from October 16. *Sec.*, C. A. Webberley, 49, Longfellow Avenue, Wellsway, Bath.

Bath and County Camera Club.—*Pres.*, Dr. R. A. Bayliss. *Meetings*, Bath Church Institute, Alternate Wednesdays, from October 14, 8 p.m. *Sec.*, Francis H. Gray, Vine House, Weston, Bath.

Batley Camera Club.—*Dead.*

***Bedford Camera Club.**—*Pres.*, Chas. E. Craddock. *Meetings*, Newnham Rooms, St. Cuthbert's Street, Mondays, 8 p.m. *Sec.*, R. Wilson, 24, Goldington Avenue, Bedford.

Beeston Photographic and Art Club.—*Pres.*, Allan F. Wood. *Meetings*, Club Rooms, Chilwell Road, Alternate Tuesdays from October 13, 8 p.m. *Sec.*, Ernest Mee, Lilac Grove, Beeston, Notts.

***Belfast Central Camera Club.**—*Pres.*, Jas. Gamble. *Meetings*, Assembly Buildings, Second Tuesdays, 8 p.m. *Sec.*, W. J. Rankin, jun., 11, Waring Street, Belfast.

Belfast City Y.M.C.A. Camera Club.—*Pres.*, A. S. Cromie. *Meetings*, Y.M.C.A., Wellington Place, First and Third Tuesdays, 8 p.m. *Sec.*, H. Stanley, 16, Rushfield Avenue, Belfast.

Belfast University Camera Club.—*Pres.*, John Wylie, B.A. *Meetings*, Students' Union, Belfast University, Second and Fourth Tuesdays, November to March, 8 p.m. *Sec.*, J. D. M. McCallum, 7, Wellington Place, Belfast.

Bellshill Y.M.C.A. Camera Club.—*Pres.*, Jas. McArthur. *Meetings*, Y.M.C.A. Tuesdays, 8 p.m. *Sec.*, Alex. Carrick, Y.M.C.A., Bellshill, Lanarkshire.

***Belmont Camera Club.**—*Pres.*, Charles Radburn. *Meetings*, Sherwood House, York Road, Battersea, S.W. *Sec.*, James Parsons, Belmont Works, Battersea, London, S.W.

Bideford Camera Club.—*Pres.*, F. W. Hockaday. *Meetings*, Bridge Chambers, Fridays, 8 p.m. *Sec.*, J. H. Alford, Fosketh, Bideford.

***Birkenhead Photographic Association.**—*Pres.*, E Newall. *Meetings*, Y M.C.A , Fridays, 8 p.m *Sec* , Verner Bickley, 145, Whetstone Lane, Birkenhead

***Birmingham Photographic Society.**—*Pres.*, Howard S. Pearson. *Meetings*, 30, Exchange Buildings, New Street, Tuesdays, 7 30 p m. *Sec.*, Philip Docker, 30, Exchange Buildings, New Street, Birmingham

Birmingham Field Naturalists' Club.—*Pres.*, W B Grove, M A. *Meetings*, People's Hall, Tuesdays, 7 30 p m *Sec.*, Herbert Thompson, 68, Castleford Road, Sparkhill, Birmingham.

Birmingham Municipal Technical School Photographic Society.—*Pres.*, W J Ballard *Meetings*, Technical School, Mondays, 7 45 p.m *Sec* , J. F. Ward, 98, Belgrave Road, Birmingham

Birmingham.—Camp Hill Old Edwardians Photographic Society.—*Pres.*, George H Ball, M A *Meetings*, Camp Hill Grammar School, Mondays, 7 45 p.m *Ex.*, November *Sec.*, W. W. Hall, "The Glen," Greenwood Road, Acocks Green, Birmingham.

Birstall Photographic Society.—*Pres.*, Albert Capstick. *Meetings*, Church Institute, alternate Thursdays from September 24, 8 p.m. *Sec.*, William Blakeley, The Pharmacy, Birstall, near Leeds

***Bishop Auckland Photographic Society.**—*Pres* , Alfred Harburn. *Meetings*, 11 Silver Street. Fridays, 8 p.m *Sec.*, J. W Rochester, 17, Southgate Street, Bishop Auckland.

Blackburn and District Camera Club.—*Pres.*, H Neville. *Meetings*, 29, Church Street, Blackburn Second Tuesdays, 8 p m *Sec.*, W. Ernest Balme, 59, Revidge Road, Blackburn.

***Blackpool and Fylde Photographic Society.**—*Pres.*, J. W. P. Loftos. *Meetings*, The White House, Blackpool, Tuesdays, 8 p.m. *Sec.*, Robert H Fisher, 43, Crystal Road, South Shore, Blackpool.

Blairgowrie and District Photographic Association.—*Pres.*, Alexander Geekie. *Meetings*, George Street, Blairgowrie, Third Tuesdays, 8 15 p.m. *Sec* , D S. Maclennan, Marchmont, Blairgowrie.

Blaydon and District Camera Club.—*Particulars not received from Secretary.*

Blyth and District Photographic Society.—*Pres.*, Lord Ridley. *Meetings*, Club House, Lynn Street, Blyth, First Mondays, 8 p.m. *Sec.*, A D. Miller, 36, Lynn Street, Blyth.

Bolton Camera Club.—*Pres.*, J. H. Galloway. *Meetings*, Bradford Buildings, Mawdsley Street, Alternate Wednesdays, 8 p.m., from October 7. *Sec.*, Fred G. Atkinson, 316, Blackburn Road, Bolton, Lancs.

Bolton Photographic Society.—*Sec* , C. K. Dalton, 50, Higher Bridge Street, Bolton.

Bootle Amateur Photographic Society.—*Pres.*, W. R. Brewster, J.P. *Meetings*, Central Library, Wednesdays, 8 p.m. *Ex.*, February. *Sec.*, George Collings, 87, Queen's Road, Bootle, Liverpool.

***Borough Polytechnic Photographic Society.** — *Pres.*, P. Carden. *Meetings*, 103, Borough Road, Wednesdays, 8.30 p.m. *Sec.*, Alfred G. Buckham, 103, Borough Road, London, S.E.

Boston Camera Club. —*Pres.*, Dr. C. W. Pilcher. *Meetings*, St. James's Schools, First and Third Tuesdays, 8 30 p.m. *Secs.*, H. M. Hames, 65, West Street, Boston, Lincolnshire.

***Bournemouth Camera Club.**—*Pres.*, Lord Abinger. *Meetings*, Cairns Hall, Alternate Mondays from November 2, 8.15 p.m. *Sec.*, Miss Penrice, 44, Lowther Road, Bournemouth.

Bournville Camera Club. — *Pres.*, W. Davenport *Meetings*, Bournville Staff Club, First and Third Thursdays, 7 15 p m., *Ex.*, March *Secs.*, G F Charlton, 341, Maryvale Road, Bournville, and Miss M Gallimore, 155, Pershore Road, King's Norton, Birmingham.

***Bowes Park and District Photographic Society.**—*Pres.*, A. Allen *Meetings*, Unity Hall, Wood Green, N., Mondays, October to March First and Third Mondays, April to September, 8 p m. *Sec*, Geo. L. Lingstrom, 206, Victoria Road, Alexandra Park, London, N.

Bradford Photographic Society.—*Pres.*, Ezra Clough. *Meetings* Mechanics' Institute, Mondays, 8 p.m. *Sec*, W. E Townend, 14, Manchester Road, Bradford

Braintree and Bocking Camera Club.—*Meetings*, The Institute. *Sec.*, Edward Fenton, Rayne Road, Braintree.

Brechin Photographic Association. —*Pres*, Wm. Shaw Adamson *Meetings*, Mechanics' Institute, Second Wednesdays, 8.15 p m. *Sec.*, D. M. Watt, 5, Union Street, Brechin.

Brentwood Photographic Society. —*Dead.*

Brighouse Photographic Society —*Particulars not received from Secretary.*

***Bristol and West of England Amateur Photographic Association.**—*Pres.*, W. N Tribe. *Meetings*, 20, Berkeley Square, Clifton, Second and Fourth Fridays, 7.30 p.m. *Sec.*, E. J. L. Gardiner, 10, Leigh Road, Clifton, Bristol.

***Bristol Photographic Club.**—*Pres*, John Fisher. *Meetings*, Stuckey's Restaurant, Wine Street, Alternate Wednesdays from October 21, 7 45 p m *Sec.*, W. F. Kuner, 62, Arley Hill, Bristol.

Bristol Imperial Camera Club. -*Pres.*, J. Fairclough. *Meetings*, Imperial Tobacco Company's Offices, Bedminster, Fortnightly, 6 15 p m, from November 12. *Sec.*, C. Derrick, 1, Salthrop Road, Bishopston, Bristol

***Bromley (Kent) Camera Club.**—*Pres*, T Davis, J P. *Meetings*, Literary Institute, First and Third Fridays, 8 15 p.m. *Sec.*, T Arnold Bennett, 24, Widmore Road, Bromley, Kent.

Burnley Photographic Society.—*Pres.*, Joseph Walton *Meetings*, Turf Street, Tuesdays, 7.30 p.m. *Sec.*, Joseph Murtagh 140, Brunshaw Road, Burnley.

Burnley Mechanics' Institution Camera Club.—*Pres.*, Rev. A. Gray. *Meetings*, Mechanics' Institution, Alternate Thursdays, 7.45 p.m., from October 15. *Sec.*, S. Richardson, 27, Slagg Street, Burnley.

Bury Y.M.C.A. Photographic Society. *Pres.*, E. W Mellor *Meetings*, Y M.C A , Tuesdays, 7 45 p m. *Sec.*, James Spencer, 100, Bury Street, Heywood, Lancs

Bury St. Edmund's Camera Club.—*Pres.*, C. M G. Cullum. *Meetings*, Y.M C A., First Tuesdays, 8 15 p m *Sec.*, Alfred E Wiggin, 15, Brentgovel Street, Bury St. Edmund's.

Buxton Photographic Society. — *Pres.*, A. Wilks *Meetings*, Collinsons' Café, Spring Gardens, Second and Fourth Thursdays, 8 p.m. *Sec.*, H. Miller, 18, Crowestones, Buxton.

***Cambridge and District Photographic Club.**—*Particulars not received from Secretary.*

Cambuslang Camera Club.—*Pres.*, David Ireland. *Meetings*, Club Room, Morriston Lane, twice monthly, Second Thursdays and Fourth Tuesdays, 8 p.m *Sec.*, Gavin Ferguson, 14, Bank Street, Cambuslang.

Camera Club, The.—*Meetings*, 17, John Street, Adelphi, W C , Thursdays, 8 30 p m *Sec.*, H. Philp, 17, John Street, Adelphi, London, W C

***Canterbury Camera Club.**—*Pres.*, Dr E Graham Wills *Meetings*, Gaywood's Rooms, Alternate Mondays, from January 4, 8.30 p.m *Sec.*, F. H. B Smith, "St. Helens," Mandeville Road, Canterbury

Canterbury Ladies' Camera Club. *Pres.*, Mrs Wells *Meetings*, Gaywood s Rooms, High Street Second and Fourth Tuesdays, 8 p m. *Sec.*, Mrs. E S. Austen, "Dormans," S Thomas' Hill, Canterbury.

Cardiff Camera Club.—*Particulars not received from Secretary.*

Cardiff Naturalists' Society (Photographic Section).—*Pres.*, Gilbert D. Shepherd. *Meetings*, 6, High Street, Second Tuesdays, 8 p.m. *Sec.*, Arthur J. Morgan, 23, Alfreda Road, Whitchurch, Glam.

***Carlisle and County Amateur Photographic Society.**—*Pres.*, John Slack. *Meetings*, none this session *Sec.*, S. W B. Jack, 19, Lowther Street, Carlisle.

Carlisle.—Border City Camera Club.—*Pres.*, John Hunter. *Meetings*, None this session *Sec.*, John Robinson, 37, Warwick Road, Carlisle.

***Catford and Forest Hill Photographic Society.**—*Pres.*, Major Sir E. F. Coates, Bart., M.P. *Meetings*, Dartmouth Hall, Forest Hill, First and Third Mondays, 8.15 p m. *Sec.*, William Thoyer Browne, 73, Silverdale, Sydenham, London, S.E.

Central Y.M.C.A. Photographic Club.—*Pres.*, J. C. S. Mummery. *Meetings*, Y.M C.A., Tottenham Court Road, Alternate Wednesdays, 8 p m , from November 4. *Sec.*, H Brown, Hostel 18, Y.M.C A., Tottenham Court Road, London, W C.

***Chelmsford Photographic Society.**—*Particulars not received from Secretary.*

***Chelsea Photographic Society.**—*Pres.*, F. Humpherson. *Meetings*, South-Western Polytechnic, Manresa Road, Alternate Thursdays, 8 p.m., from October 8. *Sec.*, L. H. Powers, 18, Glebe Place, Chelsea, London, S.W.

***Cheltenham Amateur Photographic Society.**—*Pres.*, W. J. Jeeves. *Meetings*, 1, Imperial Square, Alternate Wednesdays, 8 p.m., from October 14. *Sec.*, A. H. Smithson, "Rydal," Hewlett Road, Cheltenham.

***Cheltenham College Photographic Society.**—*Pres.*, C. E. Youngman, M.A. *Meetings*, College Physics Laboratory. *Sec.*, R. M. Towers, M.A., 7, Oriel Place, Cheltenham.

***Chester Society of Natural Science (Photographic Section).** *Pres.*, Frank Simpson. *Meetings*, Grosvenor Museum, Third Tuesdays, 8 p.m. *Sec.*, Frank Simpson, Grosvenor Museum, Chester.

Chester Y.M.C.A. Camera Club.—*Pres.*, T. C. Johnson. *Meetings*, None this session. *Sec.*, Albert E. Matthews, St. John's House, Little St. John Street, Chester.

Chichester Photographic Society.—*Pres.*, F. B. Tompkins. *Meetings*, Technical Institute, Tuesdays, 8.15 p.m. *Sec.*, J. W. Barnes, Clyde House, Chichester.

***Chislehurst Photographic Society.** *Pres.*, Rev. James Dawson, M.A. *Meetings*, Society's Rooms, Crown Lane, Alternate Mondays 8.30 p.m. *Sec.*, Miss A. J. Dawson, The Rectory, Chislehurst.

Chorley Photographic Society.—*Pres.*, Richard Gill. *Meetings*, Primrose Cottage, Library Street, Second Wednesdays, 7.30 p.m. *Sec.*, H. R. Dorning, 8, Pall Mall, Chorley, Lancs.

***City of London and Cripplegate Photographic Society.**—*Pres.*, Jesse J. Butler. *Meetings*, Cripplegate Institute, Second and Fourth Mondays, 7.30 p.m. *Sec.*, Harold Rawlinson, 87, Roman Road, Ilford, Essex.

City and Guilds (Engineering) College Photographic Society.—*Dead.*

Clapham Carlton Camera Club.—*Pres.*, Major Frank Johnson. *Meetings*, Clapham Carlton Club, First Thursdays, 8 p.m. *Sec.*, Frank Styles, 31, Englewood Road, Clapham Common, London, S.W.

Cleveland Camera Club.—*Pres.*, J. J. Burton. *Meetings*, The Studio, Clarendon Road, Middlesbrough, Mondays, 8 p.m., from October 5. *Sec.*, Arnold Bennett, Springroyd, The Avenue, Linthorpe, Middlesbrough.

Coatbridge Photographic Association.—*Pres.*, Robert H. Hobbs. *Meetings*, Carnegie Library, Second and Fourth Thursdays, 8 p.m. *Sec.*, William McAush, 3, Albany Street, Blairhill, Coatbridge.

Coatbridge Co-operative Camera Club.—*Pres.*, John Thom. *Meetings*, Library Hall, Last Fridays, 8 p.m. *Sec.*, William Bell, 29, Alexander Street, Coatbridge.

Colne Camera Club.—*Pres*, J. J. Hartley *Meetings*, Vivary Buildings, Fridays, 8 p m. *Sec*, J. H. Kay, 107, Langroyd Road, Colne, Lancs.

***Constitutional Club Employees' Camera Club.**—*Pres*, F. M Remnant *Meetings*, Constitutional Club. *Sec*, A. C. Webster, Constitutional Club, Northumberland Avenue, London, W.C.

Cork Camera Club.—*Pres*, John Day. *Meetings*, Crawford School of Art *Sec.*, J. J. England, Crawford School of Art, Cork.

Cornish Camera Club.—*Pres*, R. Pearce Couch. *Meetings*, The Studio, Penzance. *Sec*, Henry Stewart, 6, Causewayhead, Penzance

Cornwall Royal Polytechnic Society.—*Pres*, Lord St. Levan. *Meetings*, Polytechnic Hall, Falmouth, First Tuesdays, 3 30 p.m. *Sec.*, E. W. Newton, 4, Cross Street, Camborne, Cornwall.

***Coventry Photographic Club.**—*Pres*, L. P. Wilson. *Meetings*, 7, Little Park Street, Wednesdays, 8 p m. *Sec.*, G O. Seymour, 56, Holyhead Road, Coventry.

***Cowes Camera Club.**—*Pres*, W T Mahy. *Meetings*, Town Hall. None this session. *Sec*, Chas. S. Paxton, Rose Bank, Gurnard, Cowes, I.W

Cowlairs Co-operative Society Camera Club.—*Pres*, John Smart. *Meetings*, 264, Springburn Road, Glasgow, Last Fridays, 8 p.m. *Ex.*, March *Sec*, Alex. Porter, 70, Keppochhill Road, Glasgow.

***Croydon Camera Club**—*Pres.*, H. P. C Harpur *Meetings*, 128A, George Street, Wednesdays, 8 p m. *Sec.*, W. H Claypoole, B.A., 53, Ashburton Avenue, Addiscombe, Croydon.

Culcheth Camera Club.—*Pres.*, M. H. Kenyon. *Meetings*, Culcheth School, Newton Heath, Third Mondays, 8 p.m. *Sec.*, A. Lindley, 6, Aldred Street, Failsworth.

Cwmaman Amateur Photographic Society.—*Pres.*, T. Morgan *Meetings*, The Institute, Alternate Wednesdays, from November 4, 7.30 p m. *Sec.*, James Williams, 11, Railway Row, Cwmaman, Aberdare.

Darwen Photographic Association.—*Pres.*, J. W. Smith. *Meetings*, Arch Street, Thursdays, 8 p m *Ex*, March. *Sec.*, George Williams, 25, Hindle Street, Darwen

Dennistoun Amateur Photographic Association.—*Pres.*, Wm. Robb Taylor. *Meetings*, 27, Hillfoot Street, Wednesdays, 8 p.m *Ex.*, April. *Sec.*, John Macdonald, 135, Hill Street, Dennistoun, Glasgow

***Derby Photographic Society.**—*Pres.*, Rev Canon Wild. *Meetings*, none this session. *Sec*, E. Collier Green, 27, Friar Gate, Derby.

Derby.—Midland Railway Institute Photographic Society. *Pres.*, Major L Sandwith. *Meetings*, M.R. Institute, First Mondays, October to March, 7 30 p.m. *Ex.* March. *Sec.*, William Smithard, 15, Cromwell Road, Derby.

Dewsbury Photographic Society.—*Pres.*, Albert Lyles. *Meetings*, Central Liberal Club, Bond Street, Mondays, October to March, 8 p.m. *Sec.*, Joseph Garside, 45, Healds Road, Dewsbury.

Doncaster Camera Club.—*Pres.*, E. E. Burgess. *Meetings*, New Science Room, Guild Hall, Second and Fourth Tuesdays, 8.15 p.m. *Sec.*, John T Blackshaw, 52, Spansyke Street, Doncaster.

Dover Institute Photographic Society.—*Pres.*, Ernest Pain. *Meetings*, The Institute, Second Thursdays, 8 30 p m. *Sec.*, Chas C Marsh, 7, High Street, Dover

Dukinfield Photographic Society.—*Pres*, Daniel Firth. *Meetings*, Co-operative Hall, Wednesdays, 8 30 p.m. *Sec.*, J W. Carey Titterington, 28, Old Road, Dukinfield

Dulwich College Science and Photographic Society.—*Pres.*, G. T. Henderson. *Meetings*, Dulwich College, Fridays, 7 30 p.m. *Sec.*, J. A. Tennyson-Smith, Ivyholme, Dulwich Common, London, S E.

Dumbarton Co-operative Camera Club.—*Pres.*, Joseph Rae. *Meetings*, 46, High Street, First and Third Tuesdays, 7.30 p m. *Sec.*, Robert Clark, 19, Rochead Place, Dumbarton.

Dumbarton.—Denny Institute (Photographic Section).—*Pres.*, Sir Arch. Denny, LL D. *Meetings*, Denny Institute, Alternate Mondays, 8 p m., from November 2. *Sec*, Robt. M. Fortune, Photographic Laboratory, Leven Shipyard, Dumbarton.

***Dundee and East of Scotland Photographic Association.**—*Pres.* Vaness C. Baird. *Meetings*, University College, Dundee, First Thursdays, October to April, 8 p m. *Sec.*, James Slater, Rosemount, Camphill Road, Broughty Ferry.

Durham City Camera Club.—*Pres*, John Morson. *Meetings*, None this session. *Sec.*, Arthur E. Thwaites, Camborne House, The Avenue, Durham.

***Ealing Photographic Society.**—*Pres.*, G. B. Clifton. *Meetings*, Town Hall, Wednesdays, 8 p m *Sec*, Major Bartlett, The Studio, Town Hall, Ealing.

***Eastbourne Natural History Society (Photographic Section).**—*Pres.*, F. Bolton Sutton *Meetings*, Technical Institute, Fourth Thursdays, 8.15 p.m *Sec.*, Albert J. Fellows, 7, Susans Road, Eastbourne.

***East Kent Scientific and Photographic Society.**—*Pres.*, Dr. Graham Wills. *Meetings*, Beasey Institute, Wednesdays, 8 p.m. *Sec.*, A. Lander, 17, High Street, Canterbury.

Eastwood and District Photographic Society.—*Pres.*, Rev. F. W. Cobb *Meetings*, Boys' Schoolroom, First and Third Tuesdays, 7 30 p m. *Sec.* Tom Smaller, Blenheim House, Eastwood, Notts.

Edgworth and District Photographic Society.—*Pres.*, Major Booth, J.P *Meetings*, Edgworth Institute, Mondays, 7.45 p.m. *Sec*, Herbert Whitehead, 301, Bolton Road, Edgworth, near Bolton.

Edinburgh Photographic Society.—*Pres.*, R. Glode Guyer, *Meetings*, 38, Castle Street, First Wednesdays, 8 p.m. *Sec.*, George Massie, 10, Hart Street, Edinburgh.

Edinburgh Photographic Club —*Pres* , R Glode Guyer. *Meetings*, 38, Castle Street, Second Thursdays, 8 p.m., October to May. *Sec* , T. Barclay, 26, Blackford Avenue, Edinburgh

Edinburgh.—Heriot Camera Club. -*Pres* , H. B Keir, M A., B.Sc *Meetings*, George Heriot's School, Second Fridays, 8 p.m *Sec* , W H Cameron 19, Teviotdale Place, Edinburgh.

***Epsom Literary and Scientific Society (Photographic Section).**—*Meetings*, Committee Room, Public Hall, Monthly in Winter. *Sec.*, J. L. Lempriere, 6, Castle Cottages, Epsom.

Erdington Photographic Society. —*Pres.*, Thos. A Sands *Meetings*, The Church House, Mondays, 8 p m *Sec* , Alex P Campbell, 21, Oakfield Road, Erdington, Birmingham

Everton Camera Club.—*Pres* , C. F Webb, B A. *Meetings*, 3, Village Grove, Liverpool, Tuesdays, 8 p m *Sec* , William A. Mackie, 106, Snaefell Avenue, Tue Brook, Liverpool.

Exeter Camera Club.—*Pres* , J. Hinton Lake *Meetings*, Barnfield House. *Sec* , Henry N. Tanner, 23, Raleigh Road, Exeter

***Fakenham Literary, Field, and Camera Club.**—*Pres* , A. Digby, M A. *Meetings*, Lecture Hall, Tuesdays, 8 p m *Sec* , J. C Holton, Fakenham.

Faversham Institute Photographic Society.—*Pres* , Captain C. F. Hooper. *Meetings*, The Institute, East Street, Monthly, 8.15 p m. *Sec* , Wm. Whiting, Ospringe, Faversham.

Fenton Photographic Society. -*Pres* , James I. Myatt *Meetings*, Heron Cross Council Schools, Second Thursdays, 7 45 p m. *Sec.*, S. G. Challinor, 113, High Street, Fenton, Staffs.

***Folkestone and District Camera Club.** -*Pres.*, Alderman F Hall, J.P. *Meetings*, Technical Institute, First and Third Thursdays, 8 15 p.m. *Sec.*, H. Wheeler, Church Street, Folkestone

Fort William and District Photographic Society. —*Pres* , Sheriff Malcolm. *Meetings*, None this session. *Sec.*, D. S. Young, 66, High Street, Fort William.

Gateshead and District Camera Club.—*Pres.*, Councillor Robert Wilson. *Meetings*, 99, Windsor Avenue, Gateshead, alternate Wednesdays, 7.30 p m., from October 7 *Ex.*, February. *Sec* , Ralph Dickman, 206, Prince Consort Road, Gateshead.

***Glasgow and West of Scotland Amateur Photographic Association.**—*Pres.*, Jas. W. Mackenzie. *Meetings*, 180, West Regent Street, Glasgow, First and Third Mondays, 8 p.m. *Sec.*, Gilbert S. McVean, 125, West Regent Street, Glasgow.

Glasgow Eastern Photographic Association.—*Pres.*, James Robin. *Meetings*, 12A, Landressy Street, Thursdays, 8 p.m. *Sec.*, Samuel Muir, 101, Saltmarket Street, Glasgow

Glasgow (South) Camera Club.—*Pres.*, W. C. S Fergusson. *Meetings*, 43, Bankhall Street, Govanhill, Tuesdays, 8 15 p.m. *Sec.*, John Baird, 164, Kings Park Road, Mount Florida, Glasgow.

Glasgow Corporation Electric Tramways Camera Club. —*Pres.*, Robert Lawson. *Meetings*, Hayburn Street Depot. *Sec.*, James A. B. Hailey, 65, Dumbarton Road, Partick, Glasgow.

Glasgow.—St. George Co-operative Society Camera Club. —*Pres.*, Robert Park. *Meetings*, 40, Gladstone Street, Alternate Mondays, from October 12, 8 p.m. *Sec.*, A. F Galt, 1, Woodburn Place, Sandyford, Glasgow.

Glossop Dale Photographic Society.—*Dead.*

Gloucestershire Photographic Society.—*Pres.*, H Knowles *Meetings*, Technical Schools, First and Third Tuesdays, 8 15 p.m. *Sec.*, Chas. J. Scott, Hasfield, near Gloucester

Govan—Kinning Park Co-operative Camera Club.—*Pres.*, Wm. C. Stark. *Meetings*, 6, Langlands Road, First and third Wednesdays, 8 p.m. *Sec.*, D C Tonar, 893, Yoker Road, Yoker, Clydebank, Glasgow

Grangemouth Amateur Photographic Association.—*Particulars not received from Secretary*

Grange-over-Sands Literary and Scientific Society (Photographic Section).—*Pres.*, Dr. Lowther *Meetings*, Victoria Hall, First and Third Mondays 8 p.m. *Sec.*, G. Vickars-Gaskell, Park Road, Grange over-Sands, Lancs.

Grantham Photographic Society.—*Pres.*, Thos. Stow. *Meetings*, The Guildhall, First and Third Tuesdays, 8 p.m. *Sec.*, J. G. Bothamley, 22, Gladstone Terrace, Grantham.

Graphic Society, Plymouth.—*Pres.*, G. F. Treleaven. *Sec.*, I. S. Hawker, Mutley House, Plymouth.

***G.W.R. Literary Society (Photographic Section).**—*Pres.*, Col. the Hon C. E Edgcumbe. *Meetings*, 44, Eastbourne Terrace, Paddington, W. *Sec.*, Alfred G. Jones, 44, Eastbourne Terrace, Paddington, London, W.

Greenock Camera Club.—*Pres.*, John Macaulay. *Meetings*, 21, Kilblain Street, Thursdays, 8 p.m. *Sec.*, John Flockhart, 28, Nicolson Street, Greenock.

***Grimsby and District Camera Club.**—*Particulars not received from Secretary.*

***Guernsey Photographic Society.**—*Pres.*, A. T. De Sausmarez. *Meetings*, None this session. *Sec.*, Miss Mabel A. Randell, Grove End, Doyle Road, Guernsey.

Guisborough Fine Art and Industrial Society.—*Particulars not received from Secretary.*

***Guy's Hospital Nurses' Photographic Society.**—*Pres.*, Miss L. V. Haughton. *Meetings*, Nurses' Home, Guy's Hospital. *Sec.*, Miss M. Smith, Guy's Hospital, London, S.E.

***Hackney Photographic Society.**—*Pres.*, J Grice. *Meetings*, Hackney Baths, Tuesdays, 8 p.m. *Sec.*, Walter Selfe, 24, Pembury Road, Clapton, London, N.E.

Halifax Scientific Society (Photographic Section).—*Pres.*, W. Mc C. Bottomley. *Meetings*, Hanover School, Hopwood Lane, Alternate Tuesdays and Fridays, 7.45 p.m., from Sept. 29. *Sec.*, Alex. G. Naylor, 24, Abbey Walk, Halifax.

Hallside Co-operative Camera Club.—*Pres.*, Alexander Aird. *Meetings*, Victoria Hall, Alternate Fridays, 7.30 p m., from January 16. *Sec.*, William Boyd, 58, Hallside, Newton, near Glasgow.

Hamilton Natural History and Photographic Society.—*Pres.*, James Ellis. *Meetings*, Public Library, First and Second Tuesdays, 8 p.m. *Ex* , April *Sec.*, James F. Smellie, Braefindon, Allanshaw Street, Hamilton.

***Hammersmith—Hampshire House Photographic Society.** —*Pres.*, G. Hawkings. *Meetings*, Hampshire House, Thursdays, 8 30 p.m *Sec.*, M. O. Dell, 431, North End Road, Walham Green, London, S W.

***Hampstead Photographic Society.**—*Pres.*, Professor W. M. Flinders Petrie. *Meetings*, Stanfield House, Prince Arthur Road, Second Wednesdays, 8 45 p.m. *Sec* , H. Nevil Smart, 3, Northwick Terrace, St. John's Wood, London, N W.

Handsworth Photographic Society.—*Pres* , Philip Whitehouse *Meetings*, 20, Soho Road, Thursdays, 8 p.m. *Sec.*, A. E. Teague, 67, Whitehall Road, Handsworth, Birmingham.

Hanley Photographic Society (Y.M.C.A.).—*Pres.*, S A. Cutlack *Meetings*, Y M C.A. Rooms, Tuesdays, 7 45 p m *Secs.*, G. T. Boulton, 125, Gilman Street, Hanley, and W. T. Walley, 59, St. John's Street, Hanley

Hartlepools Photographic Society.—*Pres.*, S Stiover *Meetings*, Technical College, West Hartlepool, Occasional, 7 30 p m. *Sec* , R. S. Bowmar, Castlewood, Elm Grove, West Hartlepool

Haslemere and District Camera Club.—*Pres.*, Nelson K. Cherrill. *Meetings*, Educational Museum, Haslemere. *Sec.*, E W. Swanton, Educational Museum, Haslemere.

Hastings—East Sussex Arts Club.—*Pres.*, A. W. Strutt. *Meetings*, none this session. *Sec.*, W. J. Watson, Woodleigh, St. Helen's Park, Hastings.

Hebden Bridge Photographic Society.—*Pres* , Sam. Greenwood. *Meetings*, Secondary School, Second and Fourth Saturdays, 7 p.m. *Sec.*, Edward B Gibson, Croft Terrace, Hebden Bridge.

Henley-on-Thames Y.M.C.A. Amateur Photographic Society.—*Particulars not received from Secretary.*

Herefordshire Photographic Society.—*Pres* , A. Watkins, J.P. *Meetings*, 76, Eign Street, Hereford, First Tuesdays, 8 15 p m. *Sec.*, Cecil Gethen, 9, St. Nicholas Street, Hereford.

Horwich Institute Amateur Photographic Society.—*Particulars not received from Secretary.*

***Hove and Brighton Camera Club.**—*Pres.*, W. Chater Lea *Meetings*, 4A, Castle Square, Brighton, Second and Fourth Mondays, 8 15 p m. *Sec.*, Reginald J. Perry, 33, Tillstone Street, Brighton.

Huddersfield Naturalist and Photographic Society.—*Pres.*, Fred Lee. *Meetings*, Technical College, Alternate Thursdays, from October 4, 7.30 p.m. *Sec.*, A. C. Ellis, Almondbury, Huddersfield.

Hull Photographic Society.—*Pres*, J T Dyson. *Meetings*, Grey Street, Tuesdays, 8 p.m *Secs*, R Proudlove, 52, Hutt Street, Hull, and C. A. Manning, 54, Walgrave, Hull

***Ibis Camera Club.**—*Pres.*, T. C. Dewey. *Meetings*, 142, Holborn Bars. *Sec.*, E F. Simons, 142, Holborn Bars, London, E C

Idlers' Camera Club.—*Particulars not received from Secretary.*

***Ilford Photographic Society.**—*Pres*, H F Joel. *Meetings*, Cecil Hall, Wednesdays, 8 p m. *Sec.*, R. Whittingham, 20, Norfolk Road, Seven King's, Ilford, Esse

Ilkeston Arts Club.—*Pres.*, The Mayor. *Meetings*, Free Library, First Fridays, 8 p m *Ex.*, April. *Sec*, Arthur Smith, Ashville, Catherine Avenue, Ilkeston.

***Ipswich Scientific Society.**—*Pres.*, Norris Snell. *Meetings*, The Museum, First Wednesdays, 8 p.m *Sec.*, H De Beer, 93, London Road, Ipswich.

Ipswich Social Settlement Camera Club.—*Pres*, Sir Daniel F Goddard. *Meetings*, Social Settlement, Fore Street, Alternate Mondays, 8 p m, from October 12 *Sec*, Fredk. G. Mallett, Montgomery, Bishops Hill, Ipswich.

***Isle of Man Camera Club.** — *Pres*, W. Beck *Sec*, T. S. Qualtrough, 76, Buck's Road, Douglas, Isle of Man

***Isle of Wight Photographic Society.**—*Pres.*, Prof. J Milne, F.R.S., D Sc *Meetings*, none this session *Sec*, H E Hawkins, 146, High Street, Newport, I.W.

Keighley and District Photographic Association. —*Pres.*, M. S Dean. *Meetings*, Mechanics' Institute, irregular, 7 30 p.m. *Sec.*, R. Warnes, 7, Low Street, Keighley.

Kendal Photographic Society. — *Pres.*, Colonel Dr Cockill *Meetings*, Public Library, Tuesdays, 7 45 p.m *Sec*, C. S. Webb, 2, Aikrigg Villas, Kendal.

***Kennaway Photographic Society.** -*Pres.*, the Rev. Prebendary H E. Fox. *Meetings*, 16, Salisbury Square, E.C., Last Mondays, 5 30 p m. *Secs.*, W. R. C. Cooke and J. F. Young, 16, Salisbury Square, London, E.C.

Kettering Photographic Society.—*Pres*, T. G. Fraser. *Meetings*, Church Institute, as arranged, 8 p.m *Sec.*, Ernest Claypole, 112, Hawthorn Road, Kettering.

Kidderminster and District Photographic Society.—*Pres.*, Arthur Naylor. *Meetings*, Kingsley Buildings, Kidderminster, Mondays, 8.15 p.m. *Sec.*, H. W. West, 12, Birmingham Road, Kidderminster.

***Kingston-on-Thames and District Photographic Society.** —*Pres.*, Dr. A. Dashwood Howard. *Meetings*, Free Library, Kingston-on-Thames, Mondays, October to March, 8.15 p.m. *Sec.*, Albert J. P. Hayes, "Avondale," Birkenhead Avenue, Kingston-on-Thames.

King William's College Photographic Society.—*Pres.*, J. D. Paul. *Meetings*, King William's College. *Sec.*, P. L. Richardson, King William's College, Castletown, Isle of Man.

Kirkcaldy Photographic Society. — *Pres.*, John K. Melville *Meetings*, Pet Marjorie's House, High Street, Tuesdays, 8 p.m *Sec.*, Andrew Murdoch, 22, Sang Road, Kirkcaldy.

Kirkintilloch Amateur Photographic Association. — *Pres.*, Robert Smith. *Meetings*, Club Room, Broadcroft, Last Mondays, 8.15 p.m. *Sec.*, John V. McLellan, 69, Cowgate, Kirkintilloch.

Lancaster Photographic Society.—*Pres*, R. T. Simpson *Meetings*, Stonewell, Mondays, 8 p.m. *Sec.*, George E. Scott, 13, Northumberland Street, Morecambe.

Leeds Camera Club.—*Pres.*, Robert Bellis *Meetings*, Leeds Institute, Cookridge Street, Mondays, 8 p m. *Sec.*, Ernest A. Crick, Oakfield, Crossgates, near Leeds.

Leeds Photographic Society.—*Pres*, Thomas W. Thornton. *Meetings*, Leeds Institute, Cookridge Street, Tuesdays, 8 p.m. *Sec*, Robert Mackay, 69, Albion Street, Leeds.

Leek Photographic Society.—*Pres.*, J. Hall, J.P. *Meetings*, Alexandra Club, Mondays and Thursdays, 8 p.m. *Sec.*, Frank Bradley, Park Lodge, Vicarage Road, Leek, Staffs.

***Leicester and Leicestershire Photographic Society.**—*Pres.*, H. E. Baker. *Meetings*, Co-operative Buildings, Union Street, Leicester, Wednesdays, 8 p.m. *Sec*, Hy. C Cross, 80, Harrow Road, Leicester

Leicester Literary and Philosophical Society (Section G, Photography).— *Pres.*, J. T. Craig *Meetings*, Council Room, Museum, First and Third Tuesdays, 8 p.m *Sec.*, W. Pailey, 15B, Cank Street, Leicester.

Leigh (Lancs.) Photographic Society.—*Pres.*, Albert L. Makinson. *Meetings*, Market Buildings, Market Place, Alternate Thursdays, 8 15 p.m., from November 12. *Sec.*, L. E Wood, 21, The Avenue, Leigh, Lancs.

Leighton Buzzard Camera Club.—*Pres.*, Lionel de Rothschild, M P. *Meetings*, The Institute, North Street, Second and Fourth Thursdays, 7.30 p m. *Sec*, W. S. Currie, Vandyke Road, Leighton Buzzard.

Leith Amateur Photographic A sociation. — *Pres*, George Cleland. *Meetings*, 6, Charlotte Street, Last Tuesdays, 8 p.m. *Sec*, J. L. Manclark, 2, Kirkgate, Leith.

Lewes Photographic Society.—*Pres*, G J. Wightman. *Meetings*, Town Hall, First Tuesdays, 8.15 p.m *Sec.*, F. W. Davey, Moat Cottage, St Michaels, Lewes

Lewisham Century Works Camera and Art Club.—*Pres.*, L. W. Smith. *Meetings*, none this session. *Sec.*, W. H. Mern, 38, Blagdon Road, Lewisham, London, S.E.

Lewisham Y.M.C.A. Camera Club. —*Particulars not received from Secretary.*

Lincoln Amateur Photographic Society.—*Pres.*, R. C. Minton. *Meetings*, Board Room, Newland, Fridays, 8 p.m. *Ex.*, April. *Sec.*, W. Otter, 12, Broadgate, Lincoln.

***Liverpool Amateur Photographic Association.**—*Pres*, Col. Charles Brownridge, V.D *Meetings*, 9, Eberle Street, Thursdays, 7.45 p m *Sec.*, Alex W Duncanson, B.Sc , 9, Eberle Street, Liverpool

Liverpool Central Y.M.C.A. Camera Club.—*Pres* , F O. Creswell. *Meetings*, Y.M C A., Mount Pleasant. *Sec.*, J. Graham, 26, Alfred Road, Birkenhead.

***London and Provincial Photographic Association.**—*Meetings*, Food Reform Restaurant, Furnival Street, E C , Thursdays, 8 p.m. *Sec.*, Ernest Human, Birchdale, Woodlands Avenue, Wanstead, Essex.

London County and Westminster Bank Photographic Society.—*Particulars not received from Secretary.*

***London County Council Camera Club.**—*Pres.*, G. F. Brown. *Meetings*, County Hall, Spring Gardens, S W , First and Third Mondays, 5 45 p m. *Sec* , Wallace L. Jenkins, 9, Spring Gardens, Charing Cross, London, S.W.

Londonderry Camera Club.—*Pres.* Sir R Newman Chambers. *Meetings*, 12, Strand Road, First Wednesdays. *Sec.*, R W Saville, 61, Beechwood Avenue, Londonderry.

Longton and District Photographic Society.—*Particulars not received from Secretary*

Loughborough Photographic Society.—*Pres* , W. W. Coltman, J.P. *Meetings*, Church Lads' Brigade Hall, Woodgate, Alternate Fridays, 8 p.m., from October 23. *Ex* , March. *Sec* , J. E Underwood, 7, Middleton Road, Loughborough.

***Maidstone and Institute Camera Club.**—*Pres* , F. J Argles. *Meetings*, Church Institute, Alternate Mondays, 8 p m., from October 5. *Sec* , W. J Corke, 29, Charles Street, Maidstone.

***Malvern Camera Club.**—*Pres.*, Stanley Baldwin, M.P *Meetings*, Priory Place, Church Street, First and Third Mondays during winter, 8 15 p.m. *Ex.*, May. *Sec.*, J. Bate Nickolls, F.C S., The Exchange, Malvern

***Manchester Amateur Photographic Society.**—*Pres.*, Walter Johnson. *Meetings*, 5, Carr Street, Tuesdays, 7 30 p m. *Sec.*, George M. Morris, 9, Chandos Road, Chorlton-cum-Hardy, Manchester.

Manchester Photographic Society.—*Pres* , Oscar E. Taylor. *Meetings*, 135, Deansgate, Second Mondays, 7 30 p.m. *Sec.*, Stewart G. Ogden, Meadow Bank, Urmston Lane, Stretford, Manchester.

Manchester Camera Club.—*Sec.*, Charles Dawson, 34, Queen Street, Manchester.

Manchester—Simpson Memorial Camera Club.—*Pres* , Dr. A. T. Lakin. *Meetings*, Simpson Memorial, First and Third Fridays, 8 p.m. *Sec.*, G. W. Dunn, Lightbowne Road, Moston, Manchester.

Manchester Y.M.C.A. Photographic Club.—*Pres.*, H. Dumler *Meetings*, Y.M.C.A., Last Thursdays, 8 p.m. *Sec* , James Shaw, Y.M.C.A., Peter Street, Manchester

Margate Photographic and Scientific Society.—*Particulars not received from Secretary.*

***Marylebone Camera Club.**—*Pres.*, Frank O'B. Ellison, M.D. *Meetings*, 38, Upper George Street, Mondays, 8 p.m. *Sec.*, Harold G. Bailey, 10, Fulham Place, Paddington Green, London, W.

Midlothian Photographic Association.—*Pres.*, Robert Thomson. *Meetings*, 5, St. Andrew Square, Edinburgh, First and Third Thursdays, 8 p.m. *Sec.*, Chas G. Thornton, 172, Dalry Road, Edinburgh.

Mill Camera Club.—*Pres.*, E H Joynson. *Meetings*, none this session. *Sec.* W Swindon, River Cottage, St Paul's Cray, Kent.

Morpeth Y.M.C.A. Camera Club.—*Pres.*, Alderman G. B. Bainbridge. *Meetings*, Y M C.A., Mondays, 8 p m. *Sec.*, James Whittle, 30, Bridge Street, Morpeth.

Motherwell Young Men's Institute Camera Club.—*Pres.*, A. R. Florence *Meetings*, Young Men's Institute, Alternate Mondays, 8 p m, from October 5. *Sec.*, Charles Findlay, Glenorchy, Mill Road, Motherwell

***Nasmith Photographic Society.**—*Pres.*, Rev. Martin Anstey, M A. *Meetings*, 3, Bridewell Place, E C., Second Fridays, 6 30 p m *Sec.*, F. W. Cannon, 81, Waddon Road, Croydon.

Nature Photographic Society.—*Pres.*, E. J. Bedford. *Sec.*, H. Armytage Sanders, 26, Charing Cross Road, London, W.C.

***Nelson Camera Club.**—*Pres.*, Horace Eastwood *Meetings*, Co-operative Buildings, Forest Street, Tuesdays, 7.45 p.m. *Sec.*, Herbert L. Stansfield, 54, Percy Street, Nelson, Lancs.

***Nelson Photographic Society.**—*Pres.*, A. E. Normington, M.B. *Meetings*, Victoria Hall, Scotland Road, Tuesdays, 7 30 p.m. *Sec.*, Henry H. Beetham, 98, Brunswick Street, Nelson, Lancashire.

Newcastle-upon-Tyne Camera Club.—*Pres.*, J. Walton Lee. *Meetings*, none this session *Sec.*, George C. Urwin, 22, Tenth Avenue, Heaton, Newcastle-on-Tyne

Newcastle-on-Tyne St. Paul's Congregational Church Photographic Society. *Pres.*, Rev Archibald W. Jackson, B A. *Meetings*, Church Hall, Monthly, 7.30 p m. *Sec.*, William Buchan, 9, Durham Street, Newcastle-on-Tyne.

Newcastle (Staffs.) Camera Club.—*Pres.*, R. Ridgway. *Meetings*, Studio, London Road, Fridays, 8.30 p.m *Sec.*, A. C. Fisher 18, Barracks Road, Newcastle, Staffs.

New Mills and District Camera Club.—*Pres.*, James P Chettle. *Meetings*, Union Road, New Mills, Last Thursdays, 8 p.m. *Sec.*, Alfred Whitehead. 20, Lea Street, New Mills, Derbyshire.

Newport and Monmouthshire Camera Club.—*Pres.*, Rev. D. E. Llewellyn-Jones. *Meetings*, Y.M.C A, Commercial Street, Mondays, 8 p.m. *Secs.*, H. B. Redmond and H. S Kelly, 126, Stow Hill, Newport, Mon.

Night Photographers, Society of.—*Sec.*, Russell Burchall, Camera Club, 17, John Street, Adelphi, London, W.C.

Normanton and District Camera Club.—*Pres.*, Fred Thorne. *Meetings*, Guild Room, Wakefield Road, Alternate Tuesdays, 7 45 p m , from October 6. *Sec.*, A. Rogers, 36, High Street, Normanton, Yorks

***Northamptonshire Natural History Society (Photographic Section).**—*Pres* , H Manfield, M.P. *Meetings*, 63, Abington Street, Northampton, Irregular, 8 p.m. *Sec.*, J. Dickens, junr. 102, Abington Street, Northampton.

***North Middlesex Photographic Society.** — *Pres.*, Louis Dick *Meetings*, Hanley Hall, Sparsholt Road, Crouch Hill, Wednesdays, 8 15 p.m. *Sec* , E C. Ridge, 88, Ambler Road, Finsbury Park, London, N.

***North Wilts Field and Camera Club.** — *Pres* , Rev. E. H. Goddard, M.A *Meetings*, Technical School, Swindon, First and Third Tuesdays, 8 p.m *Sec.*, Owen W F. Thomas, Gwendley, Westlecot Road, Swindon.

Northwood Photographic Society.- *Pres* , Donald McMillan. *Meetings* Council Chambers, none this session. *Sec* , F. E. Hamel, Chiltern, Northwood, Middlesex

***Norwich and District Photographic Society.**—*Pres.*, A. E. Coe, *Meetings*, Castle Museum, Norwich, First Mondays, 8 p.m. *Sec.*, R J. Delf, Peoria House, 16, Park Lane, Norwich.

***Nottingham Camera Club.**—*Pres.*, Thomas Wright. *Meetings*, Mechanics' Institution, Thursdays, 7.45 p m. *Sec.*, H. Newson, Northcote House, Radcliffe-on-Trent.

Oldham Photographic Society.—*Pres* , John Fullalove. *Meetings*, Trust Buildings, Manchester ' eet, Thursdays, 8 p.m. *Sec.*, Herbert Harrison, 93, Middleton ı oad, Oldham, Lancs

Oldham Equitable Photographic Society.—*Pres.*, James Hutchinson. *Meetings*, Co-operative Room, Bottom o' th' Moor, Mondays, 7 30 p m. *Sec.*, Charles Ledger, 6, Airey Street, Oldham.

Oldham Lyceum Photographic Society.—*Pres.*, Arthur Andrew. *Sec.*, J B. Ellison, The Lyceum, Oldham.

Orchestral Photographic Society.—*Meetings*, 13, Archer Street, W., First and Third Fridays, 11 a m. *Sec.*, Herbert H. Hainton, Cartref, Leeside Crescent, Golders Green, London, N.W.

***Oxford Camera Club.**—*Pres* , Sir W. J. Herschel, Bart. *Meetings*, University Museum, Alternate Mondays, 8 p.m , from October 5. *Sec.*, Miss E Gifford, 76, Banbury Road, Oxford.

Padiham Photographic Society.—*Pres.*, F. C. Long. *Meetings*, Technical Institute, Alternate Tuesdays, 7.30 p.m., from September 29. *Sec.*, J. Rollinson, 30, Blackburn Road, Padiham.

Paisley Philosophical Institution (Photographic Section).—*Pres.*, Thomas Scott, Jr. *Meetings*, 28, Oakshaw Street, Fridays, 8 p m. *Sec.*, Alex M. Wilson, 53, Neilston Road, Paisley.

Partick Camera Club.—*Pres.*, W. Fraser Smith. *Meetings*, 63A, Peel Street, Wednesdays, 8 p.m *Sec.*, John Roberts, 34, Dudley Drive, Hyndland, Glasgow.

Pathfinders Photographic Circle.—*Meetings*, 187, High Holborn, Second Tuesdays, 7.30 p.m *Sec.*, Alfred V. Drew, 46, Bishopsgate, London, E.C.

Peterborough Photographic Society.—*Pres.*, George Kirkwood, M.D. *Meetings*, Church Institute. *Sec.*, Percy G Field, 79, Taverners Road, Peterborough.

***Photographic Society of Ireland.**—*Pres.*, W. N Allen. *Meetings*, 35, Dawson Street, Dublin, Alternate Thursdays, 8 p.m., from October 15. *Ex*, March. *Sec.*, John Rowland, 133, Strand Road, Sandymount, Dublin.

***Photomicrographic Society.**—*Pres.*, G. Ardaseer *Meetings*, 62. Chandos Street, W.C., Second and Fourth Wednesdays, 8 p m, *Sec.*, J. G. Bradbury, 1, Hogarth Hill, Finchley Road, Hendon. London, N.W.

***Plymouth Photographic Society.** — *Pres.*, W. H. Mayne. *Meetings*, The Athenæum, Alternate Fridays, 8 p m, from January 15 *Sec.*, S. Taylor, junr., 196, Union Street, Plymouth.

Plymouth Grammar School Photographic Society. — *Pres.*, C. W. Bracken, B.A *Meetings*, The Grammar School, Third Fridays, 4 30 p m *Ex*, June. *Sec.*, R. M. White, M A., 20, Caprera Terrace, Plymouth.

***Polytechnic Photographic Society.**—*Pres.*, Howard Farmer. *Meetings*, 14, Langham Place, W., Wednesdays, 8 p.m. *Sec*, W. Howard Musson, 309, Regent Street, London, W.

***Portsmouth Camera Club.**—*Pres.*, S. Dawe. *Meetings*, 52, Elm Grove, Southsea, Wednesdays, 8 15 p m. *Ex.*, May. *Sec.*, James C. Thompson, 23, Elm Grove, Southsea.

Preston Camera Club. — *Pres.*, J. Toulmin, J.P. *Meetings*, Stanley Chambers, Lancaster Road, Mondays and Thursdays, 7.45 p.m. *Sec.*, William Cowperthwaite, 46, Hawkins Street, Preston.

***Preston Scientific Society (Photographic Section).**—*Pres.*, George Howarth *Meetings*, 119A, Fishergate, Tuesdays, 8 p.m *Sec.*, W. Cragg, 45, Kingfisher Street, Preston.

Preston Pictorial Photographic Society.—*Pres.*, G. A. Booth, *Meetings*, 89, Fishergate, Fridays, 8 p m. *Sec.*, H. Ainslie Cox, 4, Powis Road, Ashton, Preston.

Prudhoe and District Camera Club.—*Pres.*, E. W. Swan. *Meetings*, Co-Operative Society's Rooms, Alternate Fridays, 7.30 p.m., from October 9. *Sec*, Charles H Hall, 26, Beaumont Terrace, Prudhoe-on-Tyne.

Rawtenstall.—St. Mary's Church Institute Camera Club.—*Dead.*

***Richmond Camera Club.**—*Pres.*, G. H. Rodman, M.D. *Meetings*, Castle Assembly Rooms, Thursdays, 8.30 p.m. *Secs.*, A. H. Etherington and C. G. Andrews, L. and S. W. Bank, Richmond, Surrey.

Rochdale Amateur Photographic Society.—*Pres.*, Isaac Renshaw. *Meetings*, 244A, Yorkshire Street, Wednesdays, 8 p.m. *Sec.*, A. F. Barnes, 25, South Street, Rochdale.

***Rochester Naturalists' Photographic Club.**—*Particulars not received from Secretary.*

Rodley and District Photographic Society.—*Pres.*, S. Walker. *Meetings*, Society's Rooms, Town Street, Rodley, Thursdays, 8 p.m. *Sec*, H. Crossley, West Royd, Rodley, near Leeds.

***Rotherham Photographic Society.** — *Pres.*, C. H. Moss, *Meetings*, Frederick Street, First and Third Tuesdays, September to April, 8 p m *Ex.*, October. *Sec*, Henry C. Hemingway, Tooker Road, Rotherham.

***Rugby Photographic Society.** —*Pres.*, A. K. Morgan. *Meetings*, Physics Laboratory, Rugby School, Monthly. *Sec.*, A H. Brett, 105, Bath Street, Rugby.

***St. Albans Camera Club.**—*Pres*, T Askwith. *Meetings*, Tankerville House, Romeland, Alternate Fridays, 8.15 p m, from November 27. *Sec.*, F. T Usher, Durham House Cumberland Road, St Albans.

St. Andrews Photographic Society.—*Pres.*, Professor J. Scott Lang. *Meetings*, 108, South Street, Irregular, 8.15 p.m. *Sec.*, Peter A Finlayson, Largo Road, St. Andrews.

St. Clements Press Photographic Society. —*Pres*, George Eaton Hart. *Meetings*, Veterans' Club, Hand Court, Holborn, Second and Fourth Thursdays, 7 30 p.m., Saturdays, April to September *Sec.*, William Turner, 31, Seven Sisters Road, Holloway, London, N.

St. Helens Camera Club.—*Pres.*, F H Latham *Meetings*, 32, Church Street, Tuesdays, 8 p m *Sec.*, J Whittaker, 158, Windleshaw Road, St. Helens.

Sale Photographic Society. —*Pres*, C. M. Dorman. *Meetings*, Reform Club, Wednesdays, 8 p.m. *Sec*, H Peddar, Heath Villa, Brooklands, Cheshire.

Salisbury Camera Club.—*Dormant.*

Scarborough and District Photographic Society. — *Pres.*, J. E. Adnams. *Meetings*, Museum, Mondays, 8 p m. *Secs.*, T. F. Brogden and Frank Foster, 92, North Marine Road, Scarborough.

Scottish Photographic Pictorial Circle.—*Pres.*, W. S. Crocket. *Meetings*, 200, Buchanan Street, Glasgow, First Wednesdays, 8 p.m. *Sec.*, Thomas Carlyle, 4, Bank Street, Paisley.

Scunthorpe and District Camera Club.—*Pres.*, Dr. Behrendt. *Meetings*, Kimberley House, Clayfield Road, Alternate Tuesdays, 7.30 p.m., from November 3. *Sec.*, E. Palfreeman, 37, Clayfield Road, Scunthorpe, Lincs.

Shaw Church Institute Photographic and Art Society.—*Pres.*, H. Buckley. *Meetings*, Church Institute, Fridays, 8 p.m *Sec.*, John Maiden, 91, Rochdale Road, Shaw, Lancs

Shaw-Crompton Camera Club.—*Pres.*, H. F Williams, J.P. *Meetings*, Club House, Collinge Street, Daily, 7 p.m. *Sec*, Urban Sellers, Fern Bank, Shaw, Lancs.

***Sheffield Photographic Society.**—*Pres.*, Henry S. Nutt, *Meetings*, Builders' Exchange, Cross Burgess Street, First and Third Tuesdays, 7.30 p.m. *Ex.*, March. *Sec.*, H. Merrill, Clevedon, Meadow Head, Sheffield.

Sheffield and Hallamshire Photographic Society.—*Pres.*, W. J. Williams. *Meetings*, Wentworth Cafe, Pinstone Street, Second and Fourth Wednesdays, 8 p m. *Sec.*, Tom Vasey, 725, Ecclesall Road, Sheffield

Sheffield Friends' Schools Photographic Society.—*Pres.*, H. C. Watson. *Meetings*, Friends' Schools, Hartshead, First and Third Wednesdays, 8 p.m. *Sec.*, John Varley, 238, Stanniforth Road, Attercliffe, Sheffield.

Shettleston Co-operative Camera Club.—*Pres.*, D. Hannington *Meetings*, 304, Main Street, Mondays, 8 p.m. *Sec.*, W. B. Whyte, 61, Main Street, Shettleston, Glasgow.

Shotts Camera Club.—*Pres.*, John McKnight *Meetings*, Strathfillan Place, Thursdays, 7.30 p m. *Sec*, Robert Fisher, 2, Green View, Shotts, Lanarkshire.

Shropshire Camera Club.—*Dead.*

***Sidcup Camera Club.**—*Pres.*, Dr. Simon. *Meetings*, Public Hall, Hatherley Road, none this session. *Sec.*, C. S. Coombes, Brookdale, Longlands Park Road, Sidcup.

Skipton —Craven Naturalists and Scientific Association (Photographic Section). *Pres.*, H Carr. *Meetings*, Art Schools, Irregular, *Sec.*, Rennie Dodgson, 15, Belgrave Street, Skipton.

Slough Photographic Society.—*Pres.*, James Andrews. *Meetings*, Leopold Institute. *Sec*, R Hallam, 58, Windsor Road, Slough.

Small Heath Photographic Society.—*Pres.*, Chas. F. Hayward. *Meetings*, Council Schools, Somerville Road, Alternate Thursdays, 8.30 p m., from October 1, *Sec*, H. Smith, 1, Miller Street, Birmingham.

***Southampton Camera Club.**—*Pres.*, W. Burrough Hill. *Meetings*, Philharmonic Hall, Mondays, 8 p.m. *Sec.*, Charles M. Cooper, 203, Shirley Road, Southampton.

South Devon Teachers' Camera Club.—*Pres.*, A. W. Searley. *Meetings*, Various, First Saturdays, 2.30 p m *Sec.*, Chas. Mole, Broadhempston, Totnes.

***Southend-on-Sea Photographic Society.**—*Pres.*, The Mayor. *Meetings*, Technical Institute, First and Third Tuesdays, 8.15 p m. *Sec.*, W. J. Sparrow, 20, Burdett Avenue, Westcliff-on-Sea.

***South Essex Camera Club.**—*Pres.*, Thos. H. B Scott *Meetings*, Carnegie Library, Manor Park, Second and Fourth Wednesdays, 8 p.m. *Sec.*, A. E. Farrants, 74, Clavering Road, Wanstead Park, Essex.

***South London Photographic Society.**—*Pres.*, H. C Beckett. *Meetings*, Central Library, Peckham Road, Mondays, 8 p.m. *Ex.*, March. *Sec.*, The Hon. Secretary, The Central Library, Peckham Road, London, S.E.

South Shields Photographic Society.—*Pres.*, A E. Cowling *Meetings*, Congregational Hall, Ocean Road, First and Third Tuesdays, 8 p.m. *Sec.*, Harrison Burgess, 6, Bright Street, South Shields.

Southport Photographic Society. — *Pres*, Dr S Tordoff. *Meetings*, 9, Corporation Street, Mondays, 8 p.m. *Sec.*, J. R. Rawlinson, 4, Maple Street, Southport.

***South Suburban Photographic Society.**—*Pres.*, John Nixon, *Meetings*, Plough Hall, Lewisham, Wednesdays, 8 p.m. *Sec.*, A L Fairbank, 67, Boyne Road, Lewisham, London, S E.

Spen Valley Literary and Scientific Society (Photographic Section). -*Pres*, Joseph Kaye *Meetings*, Field Head, Liversedge, Second and Fourth Thursdays, 8 p m. *Sec.*, Walter Cadman, 4 Granville Street, Heckmondwike.

Stafford Photographic Society.—*Pres*, W. J. Line. *Meetings*, Fowke's Studio, First and Third Mondays, 8.15 p.m. *Sec.*, A. Leonard Yapp, Augusta House, Tithe Barn Road, Stafford.

***Stalybridge Photographic and Scientific Society.** — *Pres.*, W. H Rhodes. *Meetings*, Free Library, Tuesdays, 7.45 p.m. *Sec*, Fred Whitaker, 195, Huddersfield Road, Stalybridge.

Stockport Photographic Society.--*Pres*, S B. Hooley. *Meetings*, Masonic Hall, Second and Fourth Thursdays, 8 p.m. *Sec.*, C. A. Barnes, 46, Wellington Grove, Stockport.

Stone Photographic Society.—*Pres*, W. Meakin. *Meetings*, Congregational Schools, Last Wednesdays, 8.15 p m. *Sec*, R. D. Hetherington, 15, Arthur Street, Stone, Staffs.

Stourbridge Institute Camera Club. *Pres.*, Major J. R T Mathews. *Meetings*, The Institute, Third Wednesdays, 8.30 p.m. *Sec.*, Chas. Ed Evason, 154, High Street, Stourbridge.

***Stratford.—G.E.R. Mechanics' Institution (Photographic Section).**--*Pres.*, A. J. Hill. *Meetings*, G E R. Mechanics' Institution, Store Street, Wednesdays, October to May, 8 p.m. *Ex.*, March. *Sec.*, A. Woolford, 16, Grove Green Road, Leytonstone, London, N.E.

Streatham Photographic Society. — *Meetings*, At Secretary's residence, Monthly, 8 p.m *Sec*, Charles Wills, 88, Pendle Road, Streatham, London, S.W.

***Sunderland Photographic Association.**—*Pres.*, Wm. Milburn. *Meetings*, Subscription Library, Alternate Thursdays, 8 p m., from October 29 *Sec.*, F. Ashton Milburn, 8, Thornhill Park, Sunderland.

Sunderland and District Camera Club. — *Pres.*, Octavius C. Wilmot. *Meetings*, Taylor's Studio, Holmeside, Alternate Tuesdays, 8 p m., from October 6. *Sec.*, Charles H. Griffiths, 112, Sorley Street, Sunderland.

Sutton and District Photographic Society. — *Pres.*, Alfred Clough. *Meetings*, Sutton Mill Institute, Irregular. *Sec.*, J. Bentley, 7, Eastfield Place, Sutton-in-Craven, near Keighley.

Sutton Photographic Club.—*Dead*

Swadlincote Photographic Society.—*Pres.*, G. S. Bragge. *Meetings*, Free Library, Alternate Thursdays, 8 p m., from September 24. *Sec.*, T. W. Pittam, 90, Wilmot Road, Swadlincote.

***Swansea Camera Club.**—*Particulars not received from Secretary.*

Tamworth and District Photographic Society.—*Pres.*, W. T Carrick. *Meetings*, 15, Market Street, First and Third Tuesdays, 8 p.m. *Sec.*, Miss D. R. Bird, 15, Cherry Street, Tamworth.

***"Times" Camera Club.**—*Pres.*, J. P. Bland. *Meetings*, *Times* Office, Printing House Square, E.C. *Sec.*, W. Geen, *Times* Office, Printing House Square, London, E.C.

Todmorden Photographic Society.—*Pres*, H Barker. *Meetings*, Studio, Well Lane, Tuesdays, 8 p m. *Sec.*, John W. Howorth, 5, Stones Terrace, Walsden, Todmorden.

***Tollington Park Old Tollingtonians Society (Photographic Section).**—*Moribund.*

***Torbay Camera Society.**—*Pres.*, Colonel Macmullen. *Meetings*, Wellswood Hall, Torquay, First Wednesdays, 3.30 p.m. *Sec.*, Dr. Harley Gough, Glenallon, Torquay.

***Tunbridge Wells Amateur Photographic Association.**—*Pres.*, E. R. Ashton. *Meetings*, Dudley Institute, First Wednesdays and Third Thursdays, 8 15 p.m. *Sec*, A. G. Batting, 16, Calverley Road, Tunbridge Wells.

Tynemouth (Borough of) Photographic Society.—*Pres*, Burdus Redford. *Meetings*, None this session. *Sec.*, Joseph R. Johnston, 96, Linskill Terrace, North Shields.

***United Stereoscopic Society.**—*Pres*, Dr. S. Walshe Owen. *Sec.*, A. T. Mole, 39, Westbere Road, West Hampstead, London, N.W.

***Waddon Camera Club.**—*Particulars not received from Secretary.*

Wakefield Photographic Society.—*Pres*, E Keightley. *Meetings*, Church Institute, Alternate Fridays, 8 p.m, from January 15. *Sec.*, F. J. Baines, Frampton Villa, Horbury, near Wakefield.

Walkley (Sheffield) Camera Club.—*Meetings*, Club Rooms, First Thursdays. *Sec.*, S. Hall-Downing, 288, South Road, Walkley, Sheffield.

Wallasey Amateur Photographic Society.—*Pres.*, S. K. Thackray. *Meetings*, 43, King Street, Egremont, Alternate Mondays, 8 p.m., from January 4. *Sec.*, William Hayes, 110, Brighton Street, Seacombe, Wallasey.

Walsall Photographic Society.—*Pres.*, Ald. Peter Bull, J.P *Meetings*, Arcade Assembly Hall, Mondays, 8 p.m. *Sec.*, W. T. Comer, 4 and 6, Arcade, Walsall.

***Walthamstow and District Photographic Society.**—*Pres.*, J. S. Fairfoull. *Meetings*, The Hall, Vestry Road, Walthamstow, First and Third Mondays, 8 p m. *Sec.*, S. Brigden, 8, College Road, Walthamstow, Essex.

Warrington Photographic Society.—*Pres.*, A. Davis. *Meetings*, Old Academy, Tuesdays, 7 45 p m. *Sec.*, J W. Rowland, 96, Ellesmere Road, Lower Walton, Warrington.

Watford Camera Club and Photographic Society.—*Pres.*, The Lady Ebury. *Meetings*, 100, High Street, Thursdays, 8.30 p.m *Sec.*, W. Russell Thomas, Limecote, Derby Road, Watford.

Wellcome Photographic Club.—*Pres.*, H. S. Wellcome. *Meetings*, Wellcome Club, Dartford. *Sec*, Harold King, Wellcome Club, Dartford, Kent

West Bromwich School Camera Club.—*Pres*, D. Martin Roberts, M A. *Meetings*, Municipal Secondary School, Tuesdays, 4 30 p m *Secs.*, F Law and B Summers, Municipal Secondary School, West Bromwich.

West Calder Camera Club.—*Dead.*

***Westminster City School Camera Club.**—*Pres*, Dr. E. H. Stevens. *Meetings*, The School, Mondays, 4.20 p m. *Sec.*, W. M Daniels, 32, Hogarth Hill, Golders Green, London, N.W.

West Norwood Camera Club.—*Pres.*, W. Huntington, B Sc. *Meetings*, L C C Technical Institute, Thursdays, 7 30 p m. *Ex.*, May. *Sec.*, A G Field, 28, Ilminster Gardens, London, S W.

West Stanley Photographic Society.—*Pres.*, A. Bolam. *Meetings*, Station Road, Wednesdays and Saturdays, 7 30 p.m. *Sec.*, R Simpson, 9, Co-Operative Terrace, Stanley, Durham.

***West Surrey Photographic Society.**—*Pres.*, Dr. Pearson. *Meetings*, St. Michael's Parish Rooms, Alternate Wednesdays, 8 30 p m, from November 11. *Ex*, March. *Sec.*, J. Isaac, 27, Lindore Road, Battersea Rise, London, S W.

Whitby Camera Club.—*Pres.*, William Brown *Meetings*, Waterloo Studio, Flowergate. *Sec.*, Woodhouse Parkinson, Ocean Road, West Cliff, Whitby.

Whitley District Camera Club.—*Pres.*, George Watson. *Meetings*, Exchange Buildings, South Parade, Alternate Thursdays, 8 p m, from October 8 *Sec*, Fredk. Wm. Wilson, 55, Roxburgh Terrace, Whitley Bay

Widnes Photographic Society.—*Pres.*, G. J Warner. *Meetings*, Bedford Chambers, Alternate Tuesdays, 7.45 p m, from October 13. *Sec.*, W S. Knowles, 87, Victoria Road, Widnes.

***Willesden Photographic Society.**—*Pres.*, William Bullech. *Meetings*, Polytechnic, Priory Park Road, Kilburn, Mondays, October to April, 8 p.m. *Sec*, E. Harold Ridler, 7, Bramshill Road, Harlesden London, N.W.

***Wimbledon and District Photographic Society.**—*Pres.*, T. W. Derrington. *Meetings*, Technical Institute, Gladstone Road, Thursdays, 8 p.m. *Sec.*, Frederick J. Gittins, 11, Kingsley Road, Wimbledon.

Wishaw Photographic Association.—*Pres.*, Thomas Brown. *Meetings*, Studio, Russell Street, Irregular. *Secs.*, R. Tolfer, Glasgow Road, Wishaw, and R. Andrew, Kirk Brae, Wishaw.

Wolverhampton Photographic Society.—*Pres.*, H. Holcroft. *Meetings*, Technical School, Irregular, 8 p.m *Sec*, A. Robinson, Dinmore Cottage, Penn, Wolverhampton.

***Woodford Photographic Society.**—*Pres*, F. G. Emler. *Meetings*, Wilfrid Lawson Hotel, First, Second and Third Wednesdays, 8.15 p m, October to April. *Sec.*, F. G. Emler, Murton, Chelmsford Road, Woodford, Essex.

***Woolwich Photographic Society.**—*Pres*, Charles Churchill. *Meetings*, Old Town Hall, First and Third Thursdays, 7 30 p m. *Sec.*, Herbert H. Clare, Electricity Works, Plumstead, Kent.

Worcestershire Camera Club. *Pres*, Rt. Hon. Earl Beauchamp, K.C.M.G. *Meetings*, 1A, High Street, Worcester, First and Third Wednesdays, 8 p m. *Ex.*, April. *Sec.*, P. E. Holmes, Cole Hill, Worcester.

Workington Photographic Society.—*Pres*, W. L. Fletcher. *Meetings*, Borough Club, Alternate Tuesdays, 8 15 p m., from October 13. *Sec*, Frederic C. Livesey, Oakleigh, Workington.

Worksop Photographic Society.—*Pres*, H V Machin. *Meetings*, Masonic Hall, Alternate Tuesdays, 8 p m, from October 27. *Sec.*, H. Middleton, 5, Blyth Road, Worksop

***Worthing Camera Club.**—*Pres.*, W. Ayton Gostling, M.D. *Meetings*, 11, Liverpool Terrace, First and Third Tuesdays, 8.15 p m *Ex.*, March. *Sec.*, Major Edgar Hill, Rosetta, Grove Road, Broadwater, Worthing.

York.—St. Peter's School Photographic Society.—*Pres*, S. M. Toyne. *Meetings*, St. Peter's School, Irregular *Sec*, S. W. Boldon, St. Peter's School, York.

Yorkshire Philosophical Society (Photographic Section).—*Pres.*, Cecil H. Cobb. *Meetings*, The Museum, York, First Wednesdays, 8 p.m. *Sec.*, T. W. Pottage, The Old Manor House, Fulford, York.

POSTAL CLUBS.

Amateur Postal Camera Club.—*Sec.*, W. L G Bennett, Kemerton, Paignton, Devon

Anglo-Indian Postal Photographic Club.—*Secs.*, Miss M H Mann, Swaton Vicarage, Folkingham, Lincolnshire; and P. C. Sinha, 146, Baranashi Ghose's Street, Calcutta.

Architectural Postal Photographic Society.—*Sec.*, P. H. Wenham, 34, Sir Thomas White Road, Coventry.

Argosy Postal Photographic Club.—*Sec.*, Rev. C. F. Lowry Barnwell, Stramshall Vicarage, Uttoxeter.

British Postal Camera Club.—*Sec.*, Halksworth Wheeler, Church Street, Folkestone.

Cambrian Postal Camera Club.—*Sec*, Miss Cluneglas-Davies. Millfield, Lampeter.

Camera & Co.—*Sec*, H. Wild, Berrycroft, Warwick Park, Tunbridge Wells.

Camera Club for Amateurs.—*Sec.*, E. Fawssett, Westfield, Heaton Road, Newcastle-on-Tyne.

Great Effort Postal Club (The).—*Sec.*, T. A. Rigden, Brenton, Finchley Garden Village, London, N.

Hand Camera Postal Club.—*Sec*, George V. Myatt, Sunningdale, West Worthing.

Lantern Slide Exchange Club.—*Sec*, Richard Pearse, 15, St. George's Terrace, Stonehouse, Plymouth.

Nature Stereoscopic Club.—*Sec*, G. C. S. Ingram, 52, Amesbury Road, Roath, Cardiff.

North West London Photofolio Club.—*Sec*, F. G. Clift, 108, Willifield Way, Hendon, London, N.W.

Perseverance Postal Camera Club.—*Sec.*, E. H. Plumpton, Glen Lyn, Cobham, Surrey

Postal Camera Club *Sec.*, J. C. Warburg, 21, Pembridge Gardens, London, W.

Postal Photographic Club.—*Sec*, Reginald A. R. Bennett, M.A., Walton Manor Lodge, Oxford.

Postal Pictorial Photography Club.—*Sec*, Mrs. Mary C. Cottam, Burleigh, St. Clements Road, Bournemouth.

Postal Salon.—*Sec.*, R Stockdale, 11, St John's Terrace, Belle Vue Road, Leeds.

Post Office Savings Bank Photographic Society.—*Sec.*, E. A. Ife, 45, Cassio Road, Watford, Herts.

Quarterly Photographic Portfolio.—*Sec.*, T H. Yeldham, c/o London County and Westminster Bank, 68, Victoria Street, London, S.W.

Ripon Portfolio Club.—*Sec.*, Wilfred Wainwright, Fountains Hall, Ripon.

Shropshire Postal Camera Club.—*Sec*, R. G. Vaughton Dymock, Prestfelde, Shrewsbury.

Somerset Postal Photographic Society.—For advanced workers *Sec.*, Bernard J. Mitchell, 3, Willow Vale, Frome, Somerset

Stereoscopic Society (The).—*Sec.*, B. Diveri, B.A., Huntly, N.B.

Sun and Co. Postal Club.—*Sec.*, Martin J. Harding, Oakdene, Church Stretton.

Talbot Album Club.—*Sec.*, F. H. Langdon-Davies, Mount Pleasant, Cambridge.

Three Legged Club.—*Sec.*, Miss A. K. Gubbins, Dunkathel, Glanmire, Co. Cork.

***United Stereoscopic Society.**—*Sec*, A. T. Mole, 39, Westbere Road, West Hampstead, London, N W.

Zodiac Camera Club.—*Sec.*, Miss Agnes B. Warburg, 8, Porchester Terrace, London, W

Zoological Photographic Club.—*Sec.*, Jasper Atkinson, 33, St. Michael's Road, Headingley, Leeds.

COLONIAL PHOTOGRAPHIC SOCIETIES.

Adelaide Camera Club.—*Pres.*, H. F. Holden. *Meetings*, Society of Arts, North Terrace, Second Mondays, 8 p m. *Sec* , Reginald Short, Edith Street, Adelaide, King's Park, South Australia.

Ashfield School of Arts Camera Club.—*Pres.*, Norman C. Deck. *Meetings*, Liverpool Road, First and Third Mondays, 8 p m. *Sec.*, E. P. Davidson, Edgerton, Carlisle Street, Ashfield, New South Wales.

Auckland (N.Z.) Camera Club.—*Pres* , G. O'Halloran *Meetings*, Victoria Street, Second Mondays, 8 p m *Sec* , F. J Cullen, 31, Stanley Street, Auckland, New Zealand

Auckland (N.Z.) Y.M.C.A. Camera Club.—*Pres* , T. F. Hill. *Meetings*, Y. M. C. A., Second Wednesdays, 7.45 p.m. *Sec.*, Fredk. E. Cory, Y.M.C.A., Auckland, N Z.

Australian School of Photographers.—*Pres* , F. A. Campbell *Meetings*, Working Men's College, Bowen Street, Melbourne, Last Thursdays. *Sec* , A. Norton, Wybelleena, Tennyson Street, St. Kilda, Melbourne.

Balaklava Photographic Club.—*Pres* , Rev. A H. Reynolds, B A *Meetings*, "Wooroora Producer" Office, Tuesdays, 7 30 p m. *Sec.*, B. R. Banyer, "Wooroora Producer" Office, Balaklava, South Australia.

Ballarat Camera Club.—*Pres* , G. H. Ballhausen. *Meetings* Technical Art School, Second Wednesdays, 8 p m. *Ex* , May *Sec.*, George H. Hutson, 226, Raglan Street, Ballarat, Victoria.

Ballarat Photographic Club.—*Pres* , Prof A Mica Smith *Meetings*, School of Mines, Wednesdays in each month *Sec* , Fred J. Mantell, Ballarat School of Mines, Ballarat, Victoria

Beecroft Literary Institute Camera Club.—*Pres* , Dr. Holt. *Meetings*, Literary Institute, First and Third Saturdays, 8 p.m. *Ex.*, March. *Sec.*, J. I. Forsyth, Beecroft Road, Beecroft, New South Wales.

Beechworth Camera Club.—*Pres.*, C Hembrow. *Meetings*, Public Library, Beechworth, Victoria, Second Thursday in each month, 8 p m. *Sec.*, R W Lover.

Bendigo Amateur Photographic Association.—*Pres* , J. G. Austen. *Meetings*, School of Mines, every Alternate Thursday, 8 p.m. *Ex.*, June *Sec.*, Jas. Miller, Bath Corner, Bendigo, Victoria.

Boulder Technical School Camera Club.—*Pres* , J F. Lynch. *Meetings*, Technical School, Mondays, 8 p.m. *Sec* , F A. Davis, Technical School, Boulder City, West Australia.

Burnett Camera Club.—*Pres.*, George Henry Finch. *Meetings*, School of Arts, Bundaberg. *Sec* , Horace John Page, c/o S. F. Luke, Bundaberg, Queensland, Australia.

Cairns Amateur Photographic Society.—*Pres.*, R. G. Catt *Meetings*, School of Arts, Second Thursdays, 8 p.m. *Sec.*, Arthur F. Hunt, Cairns, Queensland, Australia.

Cape Town Camera Club.—*Pres.*, Walter Johnson. *Meetings*, 10, Church Street, Fridays, 8 p.m. *Sec.*, W Askew-Way, P.O. Box 802, Cape Town.

***Cape Town Photographic Society.**—*Pres*, J. D. Cartwright, *Meetings*, Old Town House, Greenmarket Square, First Thursdays, 8 p m. *Sec*, H. W Schonegevel, P O Box 1357, Cape Town.

Ceylon Amateur Photographic Society.—*Pres.*, J. H de Saram, C.M G. *Ex*, August. *Sec*, Dr. Andreas Nell, The Victoria Memorial Eye Hospital, Colombo, Ceylon

***Christchurch Photographic Society.**—*Pres.*, W. Robinson. *Meetings*, Y.M.C A., First Mondays *Sec.*, C. G. Ingall, 29, Gordon Avenue, Christchurch, New Zealand.

Clifton Hill Amateur Photographic Club.—*Pres.*, O. H. Coulson. *Meetings*, 70, Fenwick Street, Alternate Tuesdays, 8 p.m., from July 14 *Sec.*, F. Dutton, 70, Fenwick Street, Clifton Hill, Melbourne, Australia

Dunedin Photographic Society. — *Pres.*, J. Blair Mason. *Meetings*, 3, Liverpool Street, Second Thursdays, 8 p.m. *Sec.*, A Dickison, Box 282, G.P O, Dunedin, New Zealand.

East Malvern Amateur Photographic Club.—*Pres.*, Sydney Fox. *Meetings*, St John's Parish Hall, Third Thursdays, 8 p.m. *Sec.*, Arthur H. Smith, Kilburn, 18, Wattletree Road, Malvern, Victoria, Australia.

Gawler Photographic Society.—*Pres*, H. L Marsh. *Meetings*, Alternate Tuesdays from January 4. *Sec*, Arthur A. Johnson, King Street, Gawler, South Australia.

Gloucester (N.S.W.) Amateur Camera Club.—*Pres.*, H. F. Thompson. *Meetings*, H. F. Thompson's rooms, First and Third Fridays. *Sec*, D H. Slade, Gloucester, New South Wales.

Gordon College Amateur Photographic Association.—*Pres.*, Thos. Lord. *Meetings*, Gordon Technical College, Geelong, Wednesdays, 8 p m. *Sec.*, Horace L S. Potter, 97, Weller Street, Geelong, Victoria, Australia.

Goulburn Camera Club.—*Pres.*, Ald. James Turner. *Meetings*, Bradley Street Rooms, Tuesdays, 7 30 p.m. *Sec.*, E. H. Dudley, Lithgow Street, Goulburn, New South Wales.

Gulgong Amateur Photographic Society.—*Pres.*, Archdeacon Geer. *Meetings*, Club Room, every alternate Tuesday. *Sec.*, A. P. Lambert, Public School, Gulgong, New South Wales.

Gympie Amateur Photographic Society.—*Pres.*, Geo. B. Black. *Meetings*, Club Rooms, Mary Street, Fridays, 7.30 p.m., occasionally from August 7. *Sec*, Leonard Birt, care of Scottish Gympie Gold Mines, Limited, Gympie, Queensland, Australia

Hamilton Association Camera Club, Canada.—*Pres.*, J. M. Eastwood. *Meetings*, Hamilton Association Rooms, Public Library. *Sec.*, W. Henry Edwards, 168, Main Street E., Hamilton, Ontario, Canada.

Hawke's Bay Camera Club.—*Pres.*, F. W. Williams. *Meetings*, Napier, N.Z. *Sec.*, T. Bruce Bear, c/o Napier Gas Co., Ltd., Napier, N.Z.

Ipswich (Queensland) Amateur Photographic Society.—*Pres.*, R. Henderson Johnston. *Meetings*, Hughes and Cameron's Rooms, Nicholas Street, Last Tuesdays, 7.30 p.m. *Ex.*, August. *Sec.*, Pearson W. Cameron, Nicholas Street, Ipswich, Queensland, Australia.

Johannesburg Photographic Art Circle.—*Sec.*, Harold Tayler-Smith, 71, Cuthbert's Buildings, Johannesburg.

Kapunda Photographic Club.—*Pres.*, J. E. A. Klose. *Meetings*, School of Mines, Alternate Tuesdays, 7.30 p.m. *Ex.*, September. *Sec.*, Thos. Warner, Chapel Street, Kapunda, South Australia.

King William's Town Photographic Society.—*Pres.*, Alfred Templar. *Meetings*, Border Club, Cambridge Road, 15th each month, 8 p.m. *Sec.*, Edward T. B. Gladwin, P.O. Box 33, King William's Town, Cape Province, South Africa.

Lismore Camera Club.—*Pres.*, C. St. H. Syer. *Meetings*, Studio, Molesworth Street, First Fridays. *Sec.*, Stanley I. Simmons, Lismore, New South Wales.

Manuwatu Camera Club, Palmerston North, N.Z.—*Pres.*, Jack Perrin. *Meetings*, Pratt's Hairdressing Saloon, First Mondays, 8 p.m. *Sec.*, Bert Pratt, The Square, Palmerston North, N.Z.

Maritzburg Camera Club.—*Pres.*, D. M. Eadie. *Meetings*, Hardy's Chambers, First Wednesday and Third Thursday. *Sec.*, A. R. Hopkins, 4, Hardy's Chambers, Printing Office Street, Pietermaritzburg, Natal.

Melbourne—Pictorial Photographic Workers' Society.—*Meetings*, 24, Queen Street, First Thursday, 8 p.m. *Sec.*, F. Dutton, 70, Fenwick Street, Clifton Hill, Melbourne, Australia.

Melbourne—Working Men's College Photographic Club.—*Pres.*, S. N. Rodda. *Meetings*, Working Men's College, First and Third Tuesdays, 8 p.m. *Sec.*, C. H. Deane, "Clyde," White Street, Coburg, Victoria, Australia.

Montreal Amateur Athletic Association Camera Club.—*Pres.*, B. B. Pinkerton. *Meetings*, 250, Peel Street. *Ex.*, April. *Sec.*, P. F. Calcutt, Postal Station B., Box 93, Montreal, Canada.

Mosman Photographic Society.—*Pres.*, Adam F. Grant. *Meetings*, Military Road, Third Thursdays, 8 p.m. *Ex.*, September. *Sec.*, T. Vander Horst Homan, "Redcot," Sirius Cove, Mosman, Sydney, N.S.W.

Mount Gambier Photographic Club.—*Pres.*, P. C. Kook. *Meetings*, Chess Room, Institute, First and Third Fridays. *Sec.* Edwin Kluge, Mount Gambier, South Australia.

Mount Morgan Camera Club.—*Pres.*, D. Baldwin. *Meetings*, School of Arts, First Saturdays, 7.30 p.m. *Sec.*, J. C. A. Terris, Jeannie Street, Mt. Morgan, Queensland.

Nelson Camera Club.—*Pres.*, C. Y. Fell. *Meetings*, Hardy Street, Second Tuesday in each month, 7.30 p.m. *Ex.*, October. *Sec.*, H. A. Hobbs, Hardy Street, Nelson, New Zealand.

Nelson College Camera Club, N.Z.—*Pres.*, H. L Fowler, M A. *Sec.*, G. O. Cooper, Nelson College, Nelson, New Zealand.

Newcastle (N.S.W.) Amateur Photographic Club.—*Pres* , J. T. Williams *Meetings*, 43, Hunter Street, Last Thursdays *Sec.*, Walter J. Jamieson, William Street, Hamilton, Newcastle, N.S.W.

New South Wales Railway and Tramway Camera Club.—*Pres.*, Thomas Marsh. *Meetings*, Railway Institute, Sydney, First Tuesdays. *Sec* , H. E. Perfect, Tram Depot, Rushcutters Bay, Sydney, New South Wales.

Northern Suburbs Camera Club, New South Wales.—*Pres.*, W. A. Gullick. *Meetings*, Pymble Club Hall. Third Monday in each month, 8 p.m. *Sec* , N. McIntosh.

***Northern Tasmanian Camera Club.**—*Pres.*, R. L. Parker. *Meetings*, Club Rooms, Patterson Street, Launceston, Third Wednesdays. *Sec.*, L. Griffiths, 261, Charles Street, Launceston, Tasmania.

North Sydney Tramway Camera Club.—*Pres.*, F. Simmonds. *Meetings*, Tramway Depot, Tuesdays, 8 p m. *Sec* , Wilfred J. Tamsett, 77, Holt Avenue, Mosman, Sydney, N S W.

Onehunga Photographic Society.—*Pres.*, Thos. H. Ashe *Meetings*, Holme's Hall, Third Mondays, 8 p.m. *Sec.*, Chas. A. Senior, Holme's Hall, Church Street, Onehunga, New Zealand.

Ottawa Photographic Art Club.—*Pres.*, J. G Plaskett, D.Sc. *Meetings*, Wilson's Art Studio, Sparks Street. Second Mondays, 8 p m *Sec* , William Ide, B A., 447, Riverdale Avenue, Ottawa, Ontario.

Paeroa Amateur Camera Club.—*Pres.*, E W Porritt. *Meetings*, Cameron's Studio, Second Tuesdays, 7 30 p.m. *Sec.*, John Hubbard, Paeroa, Auckland, New Zealand.

Perak Amateur Photographic Society.—*Pres.*, L. Wray, M.I.E E , F.Z S. *Meetings*, Poverty Flat, Museum Road, Taiping. *Sec.*, Geo. Bain, Taiping, Perak.

Peterborough (Ontario) Camera Club.—*Pres.*, Rev. H. R. Thompson. *Meetings*, Corner Rubidge and Sherbrooke Streets *Sec.*, N. A. Howard-Moore, Peterborough, Ontario, Canada.

Photographers' Association of Canada.—*Pres.*, J. Kennedy *Meetings*, Toronto. *Sec.*, Fred L. Roy, 140½, Hunter Street, Peterborough, Ontario

Photographic Association of Victoria.—*Pres* , J. B. Grut. *Meetings*, 57, Swanston Street, Melbourne, Wednesdays, 8 p m *Ex* , July. *Sec.*, G. H. Pattison, 108, Queen Street, Melbourne, Australia.

Photographic Employees' Association of New South Wales.—*Pres.*, J. C. Cruden. *Meetings*, Queen's Hall, Pitt Street, Sydney, Third Monday in each month. *Sec.*, Walter Davies, 58, Cavendish Street, Petersham, Sydney, N.S.W.

***Photographic Society of India.**—*Pres* , A. F. Norman. *Meetings*, 40, Chowringhee, Calcutta, Monthly. 6.30 p.m. *Sec.*, A. K. Taylor, 40, Chowringhee, Calcutta.

***Photographic Society of New South Wales.**—*Pres.*, E. T. Fabert. *Meetings*, 47, Elizabeth Street, Sydney, Second and Fourth Tuesdays, 8 p m. *Sec.*, W. A. Rainbow, Box 829, G.P.O , Sydney, New South Wales.

***Port Elizabeth Amateur Photographic Society.** *Pres.*, G. E Sargent. *Meetings*, Athenæum Buildings, Alternate Wednesdays, 8 p.m., from January 6 *Sec.*, John F. Walsh, Military Reserve, Port Elizabeth.

***Queensland Photographic Society.**—*Pres* , Hon. W. H Campbell, M.L.C. *Meetings*, Harper's Buildings, Elizabeth Street, Brisbane, Second Thursdays, 8 p.m. *Sec.*, E Colclough, Lands Department, Executive Buildings, George Street, Brisbane.

Rockhampton Camera Club.—*Pres.*, W. S. A. Hunter. *Meetings*, Club Room, Alma Street, First Thursdays. *Sec* , A. T. Nelson, c/o P. A. Nelson and Co., Alma Street, Rockhampton, Queensland.

St. John Camera Club, Canada.—*Meetings*, 65, William Street, St. John, New Brunswick. *Sec* , J Kaye Allison, P O. Box 401, St. John, N.B., Canada.

Semaphore Photographic Society.—*Pres.*, J. Smith. *Meetings*, Esplanade, First Mondays, 7.45 p.m. *Sec.*, Charles W. Mart, 16, Penong Street, Hyde Park, Semaphore, South Australia.

***South Australian Photographic Society.** —*Pres* , Charles Radcliffe. *Meetings*, Institute, North Terrace, Adelaide, Second Thursdays, 8 p.m. *Sec.*, A. H. Kingsborough, 51, Rundle Street, Adelaide, South Australia.

Southern Tasmanian Camera Club.—*Pres.*, Alan Walker. *Meetings*, Petersen's Chambers, Macquarie Street, Hobart, Third Wednesdays, 8 p.m. *Sec.*, J. H. V. Scarr, 359, Liverpool Street, Hobart, Tasmania.

Sydney—Southern Cross Camera Club.—*Pres.*, J. W. Lee. *Meetings*, 16, Redmond Street, Alternate Mondays, 7.45 p m., from July 6th. *Ex* , December. *Sec* , E. Goode, 16, Redmond Street, Leichhardt, Sydney, N.S.W.

***Toronto Camera Club.**—*Pres.*, James Y S Ross. *Meetings*, 2, Gould Street, Mondays, 8 p.m. *Ex.*, April. *Sec.*, Edward Y. Spurr, 2, Gould Street, Toronto, Canada.

Toronto Canoe Club Camera Club.—*Pres.*, H. H. Fullerton. *Meetings*, Club House, Second Thursdays, 8 30 p.m. *Sec.*, T. F. Livingstone, Toronto Canoe Club, Lake Street West, Toronto, Canada.

Toronto—Eatonia Camera Club.—*Pres.*, R. Y. Eaton. *Meetings*, Club Rooms, Yonge Street, Monays, 8 p.m. *Ex.*, April. *Sec.*, Charles A. Coles, 20, Redpath Avenue, Toronto, Canada.

Toronto School of Science Camera Club. —*Pres.*, J E. Keppy. *Meetings*, Engineering Building, University of Toronto, Alternate Thursdays from October 15. *Ex.*, March. *Sec.*, C. R. McCollum, University of Toronto, Engineering Buildings, Toronto, Ontario, Canada.

Toronto Y.M.C.A. (Central) Camera Club.—*Pres.*, Charles Boles. *Meetings*, Y.M C A. Building, 415, Yonge Street, Second Tuesdays. *Sec.*, Harry Russell, 292, Yonge Street, Toronto.

Upper Canada College Camera Club.—*Meetings*, Upper Canada College, Toronto, Ontario. *Sec.*, O. M. Biggar, 249, Simcoe Street, Toronto, Ontario, Canada.

Victorian Ladies' Photographic Association.—*Pres.*, Miss Agnes Thomson *Meetings*, Besant Lodge, Centreway, Melbourne Third Thursdays, 8 p m *Ex*, March. *Sec.*, Miss M. A. Turner, Aburn House, Auburn, Victoria, Australia.

Wallaroo Camera Club.—*Pres.*, E. Martin. *Meetings*, Institute Buildings, Fridays, 7.30 p.m. *Sec.*, Walter H. Sedgley, Wallaroo, South Australia.

Wanganui Collegiate School Camera Club.—*Pres*, H. Latter. *Meetings*, Collegiate School *Ex.*, May. *Sec*, R C. Abraham, Wanganui Collegiate School, Wanganui, N Z

***Wellington Camera Club.**—*Pres.*, A. de B. Brandon. *Meetings*, Exchange Buildings, Lambton Quay, Second Thursday in each month. *Sec.*, J. A. Heginbotham, Wellington, New Zealand.

Wellington Amateur Photographic Society.—*Pres.*, P. N. Denton. *Meetings*, Society's Rooms, 156, Lambton Quay, Alternate Fridays, 8 p.m *Sec.*, George Greig, 203, Clyde Street, Island Bay, Wellington, New Zealand.

Wellington College Camera Club.—*Pres.*, A. C. Gifford, M.A. *Meetings*, Wellington College, Wellington, N.Z., Mondays during term. *Sec.*, A. H Tattle, 18, Kent Terrace, Wellington, N.Z.

West Australian Photographic Society (Perth).—*Meetings*, Third Wednesday in each month. *Sec.*, A. R. L. Wright, Public Works Department, Perth, West Australia.

Winnipeg Camera Club.—*Pres.*, Rowe Lewis. *Meetings*, Enderton Building, Portage Avenue. *Sec*, Jas. M. Iredale, Enderton Building, Portage Avenue, Winnipeg, Canada.

Tokyo - Nippon Photographic Society. — *Pres.*, Count N. Matsudaira. *Meetings*, Society's Hall, First Saturdays, 6 p.m. *Ex.*, October. *Sec.*, Dr. K. Ando, 48, Waseda-Minamimachi, Ushigomeku, Tokyo, Japan.

Tokyo—Oriental Photographic Association.—*Meetings*, Atelier Miyauchi Hongo, Tokyo, Third Wednesdays, 8 p.m. *Ex.*, April *Sec*, Dr. K Ando, 48, Waseda-Minamimachi, Ushigomeku, Tokyo, Japan

PHOTOGRAPHIC BODIES.

Under the following heading are arranged particulars of the chief photographic associations which cannot be appropriately included in the list of photographic societies.

THE PROFESSIONAL PHOTOGRAPHERS' ASSOCIATION.

In Affiliation with the Chambre Syndicale de la Photographie et de ses Applications, of Paris.

The Association was founded in March, 1901, for the purpose of promoting the interests of professional photography, the assistance of its members in their business dealings, and rendering them advice and assistance when in legal or other difficulties.

All professional photographers in business for themselves, or as managers of firms or companies, are entitled to membership.

The subscription is 5s. per annum.

The Council generally meets the second Friday in each month, except July, August and September.

Members are entitled to transfer existing fire policies to a first-rate office at premiums 20 per cent. less than they are paying. Special arrangements have been made for insuring members' liability under the Workmen's Compensation Act.

The Association publishes annually a Handbook containing much valuable information concerning copyright and other laws which particularly affect photographers. The P. P. A. Circular, published at intervals, in addition to information concerning the work of the Association, also contains much useful information upon matters of interest and importance to professional photographers.

The Association annually holds a Congress of Professional Photographers in connection with the Photographic Arts and Crafts Exhibition at the Royal Horticultural Hall, Westminster, S.W., on similar lines to those most successfully held since 1910. Admission to the Congress is strictly confined to members of the Association.

OFFICERS, ETC.

PRESIDENT.—H. Montague Cooper.

PAST PRESIDENT.—Alfred Ellis.

MEMBERS OF COUNCIL.

London.	*Country.*
Chase, H. Gordon.	Adams, Marcus (Reading).
Corbett, Alexander.	Beaufort, J. W. (Birmingham).
Dickinson, C. F.	Brown, Frank (Leicester).
Fry, S. Herbert.	Chaplin, W. B. (Windsor)
Gray, W. E.	Chapman, H. A. (Swansea).
Hana, George.	Comley, Hy. J. (Stroud).

London.	*Country*
Hardee, Oscar.	Hadley, G. E (Nottingham).
Parker, E. H.	Illingworth, W. (Northampton).
Sims, Lang.	Lankester, P. (Tunbridge Wells).
Speaight, Richard N	Robinson, R. W. (Redhill).
St. George, H A	Spink, H. C. (Brighton).
Vandyk, H.	Turner, T. C. (Hull).

SECRETARY.—Alexander Mackie, 89, Albany St., London, N.W.
TREASURER.—S. H. Fry, 5, Highbury Grove, London N
SOLICITOR —P. E. Marshall, 35, Bedford Row, London, W.C.
AUDITORS.—A. Basil and C. St. John Vaughan

PROFESSIONAL PHOTOGRAPHERS' SOCIETY OF NEW YORK

PRESIDENT.—Y. E. Mock.
SECRETARY.—Howard Beach, Buffalo, New York.

PHOTOGRAPHIC CONVENTION OF THE UNITED KINGDOM.

The Photographic Convention was founded in 1886 for the advancement of Photography, and to afford opportunities for personal intercourse and exchange of ideas amongst those interested in the Art, from all parts of the United Kingdom.

The Thirtieth Annual Meeting will be held in July, 1915. Retiring President—G. W. Atkins

Meetings have been held at the following Centres:—1886, Derby; 1887, Glasgow; 1888, Birmingham; 1889, London; 1890, Chester; 1891, Bath; 1892, Edinburgh; 1893, Plymouth; 1894, Dublin; 1895, Shrewsbury; 1896, Leeds; 1897, Great Yarmouth; 1898, Glasgow (second visit), 1899, Gloucester; 1900, Newcastle-on-Tyne; 1901, Oxford; 1902, Cambridge; 1903, Perth, 1904, Derby (second visit), 1905, Dublin (second visit); 1906, Southampton; 1907, Hereford; 1908, Brussels; 1909, Canterbury; 1910, Scarborough; 1911, Exeter, 1912, Amsterdam, 1913, Bangor; 1914, Perth (second visit)

PAST PRESIDENTS.—J. Traill Taylor, Andrew Pringle, C. H. Bothamley, George Davison, William Bedford, George Mason, Sir Howard Grubb, A. Haddon, H. P. Robinson, F. P. Cembrano, John Stuart, William Crooke, Thomas Bedding, Sir William Herschel, Bart., Sir Robert S. Ball, Sir Robert Pullar, G. Herbert Strutt, Dr. John Joly, E. J. Humphery, Alfred Watkins, Sir Cecil Hertslet, H. Snowden Ward, Godfrey Bingley, J. B. B. Wellington, F. J Mortimer.

The Council of the Convention is empowered to make grants in aid of photographic research.

MEMBERS OF COUNCIL.

W. J Ballard (Birmingham).	F. B Cattley (Scarborough)
R. R Beard (London).	Henry Coates (Perth).
A. Bedding (London).	G. B. Clifton (Ealing).
E. A. Biermann (Birmingham)	E. F. H. Crouch (Worthing).
Ignace Bispinck (Amsterdam)	R. C. Davies (Liverpool).
G. E. Brown (London).	A. H. De'Ath (Ashford).
Walter H Brown (London)	E. Dockree (London).
C. P. Butler (London).	F. Martin Duncan (London).

MEMBERS OF COUNCIL (*cont.*).

W. E. Dunmore (Paris).
Dr. A. R. F. Evershed (London).
Cecil Gethen (Hereford).
T. K. Grant (London).
H. W. Hall (Elstree).
W. S. Hobson (Leicester).
T. Illingworth (London).
F. E. Jones (London).
J. Norval (Dunfermline).
Walter F. Potter (London).
A. Roods (London).
P. R. Salmon (London).
J. R. A. Schouten (Amsterdam).
T. Scotton (Derby).
A. F. Sergeant (Halifax).
H. M. Smith (Geneva).
W. H. Smith (Purley).
F. B. Tompkins (Chichester).
G. W. Watson (London).
Courtenay Wells (Gloucester).
A. Werner (Dublin).
C. Winter (London).
B. J. Whishaw (Cheltenham).
S. H. Wratten (Wealdstone).

TRUSTEES.—George W. Atkins; Frederick Albert Bridge.

GENERAL SECRETARY AND TREASURER.—F. A. Bridge, Downshire House, 128, Barry Road, East Dulwich, S.E.

PHOTOGRAPHIC SURVEY ASSOCIATIONS.

PHOTOGRAPHIC SURVEY OF EDINBURGH AND DISTRICT.

SECRETARY.—John R. Hamilton, Edinburgh Photographic Society, 17, Leopold Place, Edinburgh.

Number of prints (housed at City Museum, Edinburgh) about 1 000.

PHOTOGRAPHIC SURVEY OF ESSEX.

Headquarters: Essex Museum of Natural History, Romford Road, Stratford.

PRESIDENT.—S. Hazzledine Warren, F.G.S.

SECRETARY.—V. Taylor, 49, Pulteney Road, South Woodford, Essex.

Number of prints (housed at Essex Museum, Stratford) 2,200

KENT COUNTY PHOTOGRAPHIC RECORD AND SURVEY.

PRESIDENT.—Sir David Salomons.

SECRETARY.—H. E. Turner, B A., B Sc., 14, Queen's Road, Tunbridge Wells.

PHOTOGRAPHIC SURVEY RECORD OF NORFOLK AND NORWICH.

PRESIDENT.—Russell J. Colman, D.L., J.P.

SECRETARY.—Geo. A. Stephen, Public Library, Norwich

Number of prints (housed at Public Library, Norwich) 1,817.

PHOTOGRAPHIC SURVEY AND RECORD OF SURREY.

PRESIDENT.—Hon. Henry Cubitt, Lord Lieutenant of Surrey.

SECRETARY.—Jarvis Kenrick, Bletchingly.

Number of prints (housed at Public Reference Library, Croydon about 7,000. Also 1,500 lantern slides.

PHOTOGRAPHIC RECORD AND SURVEY OF SUSSEX.

PRESIDENT —The Duke of Norfolk, E.M., K.G

SECRETARY.— Frederick Harrison, M.A., 17, Compton Avenue, Brighton.

Number of prints (housed at Public Library, Brighton) 1,4 9. Also 485 lantern slides.

PHOTOGRAPHIC SURVEY OF WALES.

DIRECTOR.—W. Evans Hoyle, M.A., D.Sc.

Full particulars of scheme of subjects, etc., may be obtained from the Secretary of the local Committee, Archibald H. Lee, c/o National Museum of Wales, Cathays Park, Cardiff.

Number of prints (housed at the National Museum, Cardiff) 300 Also 370 lantern slides

PHOTOGRAPHIC SURVEY OF WARWICKSHIRE.

PRESIDENT—A J. Leeson.

SECRETARY AND CURATOR—Lewis Lloyd, Church Road, Moseley, Birmingham.

TREASURER.—S. J. Ford, King Edward's School, New Street, Birmingham.

Number of prints (housed at Reference Library, Birmingham) about 4,000.

PHOTOGRAPHIC SURVEY OF WORCESTERSHIRE.

SECRETARY.—Edgar M. Firth, Enderlie, Arboretum Road, Worcester.

Number of prints (housed at Victoria Institute, Worcester) 704.

THE FEDERATION OF PHOTOGRAPHIC RECORD SOCIETIES.

CHAIRMAN.—W Whitaker, B.A., F.R S., F.G.S.

TREASURER.—G. Scamell, F.R P.S.

SECRETARY.—W. W. Topley, 53, Coombe Road, Croydon.

The Federation consists of 3 Societies.

THE LONDON SALON OF PHOTOGRAPHY.

The object of the London Salon of Photography is to foster pictorial photography by exhibition of pictures in which individual artistic aim and feeling have found their expression by means of the camera. It is international in character. An Annual Open Exhibition is held at one of the most important Picture Galleries in London. New members are elected from the exhibitors at the annual Salon. The members of the London Salon of Photography are:—

Yarnall Abbott (Philadelphia).
Marcus Adams (Reading).
J. H. Anderson (London).
E. R. Ashton (Tunbridge Wells).
Mrs. G A. Barton (Birmingham).
A. H. Blake (London).
Dr. E. G. Boon (Alassio).
R. M. Cocks (London).
R. L. Cocks (London).
Reginald Craigie (London).
Harold Crawford (Leeds).
D'Ora (Vienna).
R. Dührkoop (Hamburg).
Otto Ehrhardt (Dresden).
Rudolph Eickemeyer (New York).
B. F. Eilers (Amsterdam).
C. H. L. Emanuel (London).
Hugo Erfurth (Dresden).
Victor Hoffmann (Buda Pesth).
T. Hofmeister (Hamburg).
O. Hofmeister (Hamburg).
E. T Holding (London).
Charles Job (Hove).
Gertrude Käsebier (New York).
Mrs. Minna Keene (Cape Town).
Alex. Keighley (Steeton).
H. Mortimer Lamb (Montreal)
F. Austin Lidbury (Niagara Falls).
Arthur Marshall (Nottingham).
J. McKissack (Glasgow).
Leonard Misonne (Gilly).
F. J. Mortimer (London).
Ward Muir (London).
Hector E. Murchison (London).
Bertram Park (London).
Josef Pecsi (Buda Pesth).
Nicola Perscheid (Berlin)
Paul Pichier (Vienna)
W. H. Porterfield (Buffalo).
Guido Rey (Turin).
J. B. B Wellington (Elstree)
J. M. Whitehead (Alva)
Fritz Widder (Buda Pesth).
C. Wille (London).
Percy G. R. Wright (London).

Secretary of the Salon.—Bertram Park, 5a, Pall Mall East, London, S.W.

*THE SOCIETY OF COLOUR PHOTOGRAPHERS.

SECRETARY.—Arthur E. Morton, 97, Chesterfield Gardens, Harringay, London, N.

PORTFOLIO SECRETARY.—F. T. Hollyer, 9, Pembroke Square, W.

COMMITTEE.—George E. Brown, H. Essenhigh-Corke, A. W Everest, A. J. Newton, Percy B. Tubbs, J. C. Warburg, and the Secretaries.

The Society has for its object "to further the progress of colour photography." It is open to all interested in colour photography, the annual subscription being 5s.

The avowed activities of the Society are:—

(a) The mutual interchange of ideas and experiences in colour photography by means of lectures, discussions, and a circulating portfolio of specimens and MSS., which shall include questions and replies

(b) To obtain for members assistance by correspondence from more experienced workers through the medium of the honorary secretary.

(c) To hold an annual exhibition in London, open to members and non-members.

(d) To form a permanent collection of specimens, apparatus, etc.

(e) To arrange periodical instructional excursions to places of interest

THE AFFILIATION OF PHOTOGRAPHIC SOCIETIES

WITH THE ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN.

CHAIRMAN OF EXECUTIVE COMMITTEE.—G. B. Clifton.

SECRETARY.—J. McIntosh, 35, Russell Square, W.C.

BENEFITS AND PRIVILEGES.—Affiliated Societies are entitled to the following benefits and privileges :—

The loan of illustrated lectures on photographic and kindred topics, sets of lantern slides, lantern lectures, pictures for exhibition, etc., and interchange of lectures and lecturers between the affiliated societies.

Permits to photograph (see below).

One copy of each issue of the "Photographic Journal," in which are published the proceedings of the Affiliation Committee, the Transactions of the Royal Photographic Society of Great Britain, etc.

Admission to the Annual Exhibition of the Royal Photographic Society of Great Britain at reduced prices.

Members of affiliated societies joining the Royal Photographic Society of Great Britain receive exemption from the payment of entrance fees, provided they are and have been for at least two years members of an affiliated society.

Temporary use of the accommodation provided by the various societies to members of other societies away from their own districts, as a matter of grace, not as a right.

Annual competitions of pictorial photographs and lantern slides are arranged.

JUDGING SOCIETY COMPETITIONS.—Any affiliated society may send prints or slides entered for its competitions to be judged by one or more of the board of judges. If the board are not able to meet for the purpose, the executive committee will appoint a judge or judges.

MANAGEMENT.—Every affiliated society has a voice in the management of the affiliation through the two delegates which each is entitled to appoint. The general body of delegates meet once a year, the business in the meantime being conducted by an executive committee. The two delegates appointed by each society need not necessarily be members of the society they represent. The entire income of the affiliation, with the exception of a charge made for clerical expenses, is placed by the Royal Photographic Society in the hands of the executive committee, which has to defray all expenses in connection with the work of the affiliation with the following exceptions: The Royal Photographic Society provides meeting-rooms, and office accommodation free of charge.

PERMITS TO PHOTOGRAPH. — Arrangements have been made whereby members of affiliated societies will be permitted to photograph in or at the following places without other formality than he production of the Red Book (which is non-transferable), if required by those in charge. This permission is subject to any

special arrangements that may be made from time to time by the authorities, and it should be understood that these concessions are granted as a matter of grace and not as rights. Holders of the Red Book are expected to act accordingly :—Alexandra Palace and Park, Bristol Cathedral, Lichfield Cathedral, Romsey Abbey, Burnham Beeches, *Bushey Park, Coulsdon Common; Guildford, Abbotts (Trinity) Hospital; Guildford, Town Hall Interior "at convenient times"; Guildford, Holy Trinity Church, Guildford St. Mary's Church; *Green Park, *Greenwich Park, *Hampton Court Park, Gardens, and Green, Highgate Wood, *Hyde Park, *Kensington Gardens, *Kew Green, *Natural History Museum Gardens, *Parliament Square Gardens, *Primrose Hill, *Regent's Park, *Richmond Park and Green, *St. James's Park, St. Paul's Churchyard (to 12 noon), *Victoria Tower Gardens.

The societies forming the affiliation are indicated by an * in the list of photographic societies preceding and following.

CONFERENCE OF JUDGES.—The following rules and recommendations concerning photographic exhibitions, adopted by a meeting of judges, convened by the affiliation on April 11, 1900, and revised in June, 1903. The committee of the affiliation entertain the hope that every affiliated society will endeavour to conform to them as closely as possible. The rules are known to have proved decidedly beneficial in the past

RULES.—1. The judges' decision upon the merit of the exhibits shall be final, and they shall not be asked to decide any other point.

2. The judges shall have full power to withhold any award, and this shall be stated in the prospectus.

3. The judges shall have power to exclude all persons from the room while judging.

4. The judges' expenses shall be paid.

5. The judges shall not adjudicate upon pictures exhibited as produced with wares of special trading firms.

6. No award shall take the form of a money prize

7. Where there is a champion class, pictures which have previously taken awards in Open classes shall be exhibited in the champion class only.

8. An award shall be made to one picture only, whether it is in print, lantern slide, or other form; but in cases where the exhibition rules provide for slides to be exhibited in sets, the award shall be made to the best slide in the best set.

THE SCOTTISH PHOTOGRAPHIC FEDERATION.

PRESIDENT.—Provost Davio, Coatbridge.

SECRETARY.—James W. Mackenzie, 153, Hope Street, Glasgow.

SECRETARY (Portfolio).—J. D. Ross, 10, Latch Road, Brechin.

SECRETARY (Lantern Slide).—G. Cleland, 15, Braid Crescent, Edinburgh.

* In those places indicated by an asterisk only *hand cameras* may be used under this permit, and the photographing of persons or groups is not permitted.

The Federation promotes annually The Scottish Photographic Salon. It is possible that no Salon will be held in 1915

SALON SECRETARY —Wm McAnsh, 3, Albany Street, Blairhill, Coatbridge.

The Federation consists of 44 societies.

THE YORKSHIRE PHOTOGRAPHIC UNION.

PRESIDENT.—J. W. Wright.

BUSINESS SECRETARY.—Ezra Clough, 10, Farcliffe Road, Bradford.

SECRETARY (Lantern Slide Section). — W. H. Womersley, Spring Hurst Road, Shipley.

SECRETARY (Print Portfolio Section). — Walter Trickett, Elm Farm, Bramley, near Leeds.

The Union consists of 26 societies.

THE LANCASHIRE AND CHESHIRE PHOTOGRAPHIC UNION.

PRESIDENT.—S. L. Coulthurst.

SECRETARY.—Fred. Whitaker, 195, Huddersfield Road, Stalybridge.

SECRETARY (Travelling Exhibition Prints).—T. Lee Syms, 69, Castle Street, Tyldesley.

SECRETARY (Lantern Slide Section).—H. Harrison, 93, Middleton Road, Oldham.

SECRETARY (Print Portfolio Section).—R. Wright, 15, Roosevelt Drive, Aintree, Liverpool.

A year-book is published, with a list of societies, lecturers and demonstrators, judges for exhibitions, etc.

The Union consists of 47 societies.

MIDLAND PHOTOGRAPHIC FEDERATION.

SECRETARY.—Lewis Lloyd, Church Road, Moseley, Birmingham

The Federation consists of 34 societies.

FEDERATION OF THE PHOTOGRAPHIC SOCIETIES OF NORTHUMBERLAND AND DURHAM.

PRESIDENT.—Wm. Milburn, F.R.I.B.A.

SECRETARY.—Robert Chalmers, 17, Fawcett Street, Sunderland.

The Federation consists of 16 societies.

EAST ANGLIAN PHOTOGRAPHIC FEDERATION.

PRESIDENT.—Bertram Cox.

SECRETARY AND TREASURER.—E. Peake, Rydal House, Earlham Road, Norwich.

SECRETARY (Print Portfolio Section) —Bertram Cox (Lincoln)

SECRETARY (Lantern Slide Section) —C. H. Wallis (Chelmsford).

The Federation consists of 18 societies,

SOUTHERN PHOTOGRAPHIC FEDERATION.

PRESIDENT.—S. Dawe.

BUSINESS SECRETARY —Jas. C. Thompson, 23, Elm Grove, Southsea.

SECRETARY (Lantern Slide Section).—F. T. Kioldsen, 6, Canfield Gardens, Finchley Road, London, N.W.

SECRETARY (Portfolio Section).—F. Baker, 33, Suffolk Avenue, Southampton.

The Federation consists of 10 societies.

FEDERATION OF THE PHOTOGRAPHIC SOCIETIES OF WALES AND MONMOUTHSHIRE

PRESIDENT.—E. H. Griffiths. Sc.D., F.R S

SECRETARY.—T. J. Lewis, 201, Barry Road, Barry, Glam.

The Federation consists of 7 societies.

INTER-CLUB PHOTOGRAPHIC ALLIANCE.

PRESIDENT —John Bonnard.

SECRETARY —Arthur Clayton, 41, Revidge Road, Blackburn

The Alliance consists of 17 societies

THE PHOTO-SECESSION

DIRECTOR.—Alfred Stieglitz, 1111, Madison Avenue, New York, U.S.A.

Place of meeting, 291, Fifth Avenue, New York. The Secession holds continuous exhibitions in its galleries, not only of the most advanced international pictorial photography, but also of the most advanced international art expressions in other media.

TO AUSTRALIAN READERS.

A complete set of the "British Journal Almanac," from its establishment in 1861 to the present volume, has recently been brought together by Mr. J J. Rouse, of Messrs Kodak (Australasia) Ltd, and may be consulted by any photographer at the firm's offices. 379, George Street, Sydney, N.S. Wales.

A Corner of Chartres Cathedral

(from a snapshot by Ernest Savory)

THE BRITISH JOURNAL
PHOTOGRAPHIC ALMANAC

AND

Photographer's Daily Companion

WITH WHICH IS INCORPORATED

The Year Book of Photography and Amateurs' Guide
"The Photographic Annual."

1915.

EDITED BY GEORGE E. BROWN, F.I.C.

FIFTY-FOURTH ISSUE

LONDON:
HENRY GREENWOOD & CO., LTD., PUBLISHERS,
24, WELLINGTON STREET, STRAND.

31*

PREFACE.

This fifty-fourth annual volume of the "Almanac" is issued in an increased edition of 30,000 copies For some year or two the publishers have been unable to supply the demand, but it is hoped that the present larger edition will ensure every would-be purchaser obtaining his copy.

As was to be expected, the present disastrous European War has had a considerable influence upon the extent to which firms in the photographic trade have taken advantage of the wide advertising powers of the "Almanac." Channels of trade have been interrupted, and supplies of raw material disturbed Yet the effect is really less than might have been anticipated. In the case of only very few British firms are announcements altogether absent.

A further effect of the war is the number of goods previously made in Germany which are now manufactured in Great Britain. The time since the outbreak of the war has been comparatively short, and there is no doubt that many other goods of which before the war practically the sole source of supply was Germany, will be produced in this country. National sentiments, which naturally have been hotly aroused by the war, are bound to be a factor in this as in other branches of trade and in the British colonies, perhaps even more than here, will create a greater demand for all-British manufactures. When the war is ended, as we all hope it may be before the next "Almanac" is issued, we may expect to see the British photographic trade further extended and strengthened in all the great markets of the world.

GEORGE E. BROWN,

Editor.

24, Wellington Street,

Strand, London.

December 3, 1914.

LONDON: HENRY GREENWOOD & CO., Ltd.,
Publishers of *The British Journal of Photography*,
24, Wellington Street, Strand, W.C.

CONTENTS.

MODERN METHODS OF ENLARGING.

BY THE EDITOR.

A book might be written on the methods and apparatus employed in enlarging, and therefore in this article I have sought to keep fairly closely to the processes which are in practice at the present day and utilise the various types of enlarging apparatus on the market. Except in certain practical applications no attempt has been made to deal with the optics of enlarging. It is hoped that the tables and formulæ given in the later sections of this volume (p. 713) contain the information which is necessary in computing the dimensions of the optical system for different degrees of enlargement with lenses of different focal lengths. Generally the worker has no inclination and little need to trouble himself about these latter: he has only to go ahead in the use of very simple apparatus and learn for himself the fascination of photographic enlarging.

Fixed-Focus Enlargers.

The fixed-focus enlarger is quite the simplest and cheapest form of enlarging apparatus, but is not on that account to be despised. For certain purposes it is the most useful pattern of enlarger which can be employed. Its limitations are :—1. It enlarges upon one, and only one, given scale, *e.g.*, quarter-plate to whole plate, 3½ x 2½ to postcard and so on. 2. The whole of the negative is reproduced in the enlargement. 3. It is not possible to shade parts of the paper during exposure. But, on the other hand, it is very rapid in use—an enlargement is made almost as quickly as a contact print—and the apparatus is always ready to hand without need of making things ready. If your small negatives are made with a stand camera or a reflex, or with any camera which gives you a fair average of subjects which are well placed on the plate, you cannot have a more convenient means of getting prints of respectable size, such as are necessary for reproduction in the press. For this an enlarger giving

8½ x 6½ prints from quarter-plates,
6½ x 4¾ prints from 3½ x 2½ in. plates,
or postcard prints from 4½ x 6 cm. plates

is the usual and most advisable choice. The two first give almost the same degree of enlargement—roughly, two diameters—so that

the smaller ($3\frac{1}{2} \times 2\frac{1}{2}$) negatives can be used in the quarter-plate enlarger For $4\frac{1}{2} \times 6$ cm negatives, the scale of enlargement requires to be a little greater in order to obtain postcards with the picture right up to the edges

Fig 1 shows the simplest form of the fixed-focus enlarger a tapering box with a frame at one end to hold the negative, and at the other a loose square cap or lid in which the bromide paper

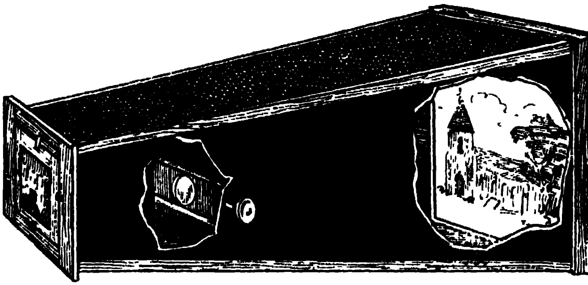

Fig. 1—The Fixed-focus Box Enlarger the simplest of all Enlarging Cameras

is laid The lens, mounted midway in a partition, is fitted with a simple shutter, which is operated by pulling out and pushing in the handle Fig 2 is a somewhat more convenient pattern The paper is held in a dark slide, and the trouble of taking the enlarger into the dark to load it is thus avoided These en

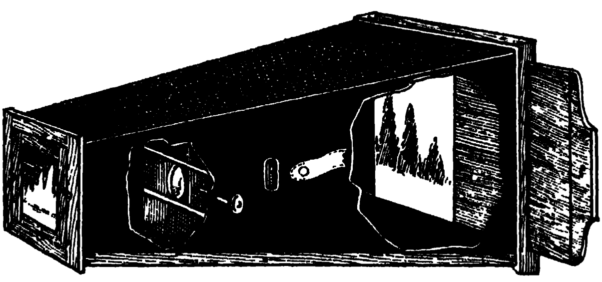

Fig. 2.—Fixed-focus Enlarging Box with Detachable Holder of the paper

largers, as shown, are for use in daylight. They are stood pointing to a clear sky, the exposure depending only on the density of the negative and the strength of the light An ordinary meter is a great help in finding the correct exposure It measures one factor, and leaves only the other (and the easier), that is the density of the negative, to the judgment of the worker.

But the fixed-focus enlarger may be used by artificial light a

plan which has the advantage of making correct exposure easier than with daylight since the light is reasonably constant. A drawback to it is the rather long exposure, for such enlargers are usually fitted with cheap slow lenses, and with a negative of any-

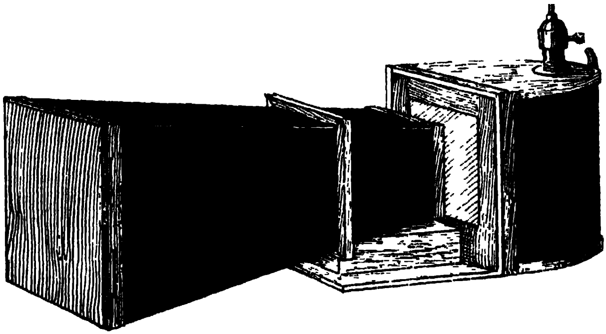

Fig 3.—Fixed-focus Enlarger with Artificial Light.

thing like density the exposure may run into minutes Bromide paper, and that of the most rapid kind, is necessary; gaslight paper is out of the question The light may be gas or electric, and be direct or reflected If direct it is diffused through a

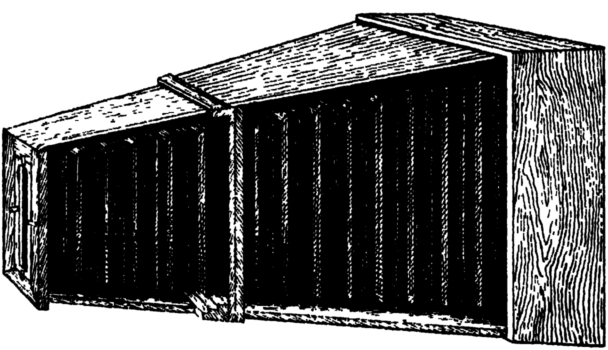

Fig 4.—Collapsible Fixed-focus Enlarger, usually made for two different scales of enlargement.

screen, say, of flashed opal, as in Fig 3, which is closely on the lines of the Kodak enlarger The alternative plan is to use reflected light in one or other of the illuminating chambers, made for both gas and electric lamps Such chambers, which are very

convenient alternatives to a condenser, are described in a later paragraph.

A further pattern of the fixed-focus enlarger is one which folds (Fig. 4). It is a convenience, particularly when making enlarged prints on tour. In these days of very small cameras and development tanks it is no great trouble to develop, fix, and wash negatives *en route*, and when that is done a folding *daylight* enlarger *plus* some gaslight paper enables one to produce prints of respectable size, say, half-plate or whole-plate, under the most primitive conditions. An apparatus of this form has the further advantage that it usually is made with a simple adjustment for two degrees of enlargement. You can enlarge a quarter-plate to whole-plate (2 diameters) or to 15 x 12 (about 4 diameters). Really the chief use of this is not to get a larger print from the whole negative, but to enlarge a part only of the negative to the smaller of the two sizes of paper which the enlarger is made to take. In other words, you make a whole plate print either from the whole negative or from half of it.

Daylight Enlarging.

Years ago daylight was the source of light used exclusively for enlarging simply because, with the exception of oxy-hydrogen limelight, there was no light powerful enough for the slower papers then in use. But the many convenient forms of electric lamps and gas burners have altered all that, and it is the exception to find any

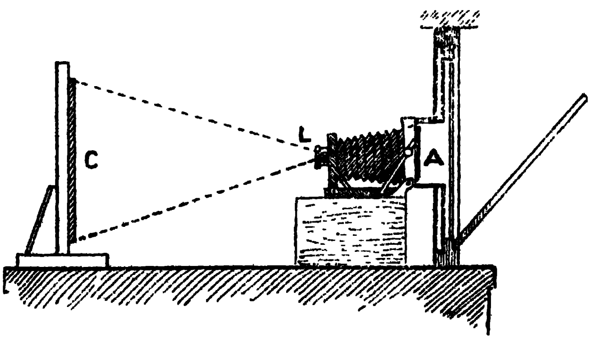

Fig. 5.—Enlarging by daylight, by means of camera fitted to shutter of window. A, the negative; L, lens; and C, easel.

enlarging, amateur or professional, done by daylight. Yet, owing to its perfect diffusion, daylight is excellent for enlarging providing that it can be obtained uniform over the area of the negative; which often it cannot in consequence of buildings near at hand. Usually it is advisable only when a room, by its situation, is specially fitted for obtaining an even flood of daylight directly from the sky or by reflection. In using it for this purpose the two alternative plans are:—(1) To fit a camera to an aperture in a shutter of the window, casting the enlarged picture on an easel (Fig. 5); or (2) to use two

cameras—a smaller to hold the negative and a larger for the bromide paper—mounted on a board. The whole arrangement (Fig. 6) can be directed to the sky or the light obtained in the negative by re-

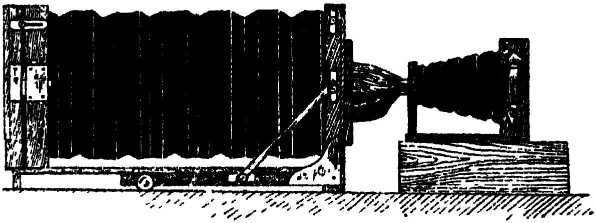

Fig. 6.—Daylight enlarging with large and small cameras connected by Light-tight Bag.

flection The first of these is much the better if circumstances allow of it, because the easel is open and the paper can be shaded, vignetted, etc., during exposure; also any size of enlargement, limited only by the size of the easel, can be obtained. The camera requires to extend no more than twice the focal length of the lens, since this permits of same-size "enlargement." For larger pictures the extension is less. The camera used in taking the negative, if of the customary front-focussing pattern, is as convenient a one as can be used. It is best to make and fit to the back a frame to hold the negative, and with its back surface velvetted, in order to make a good junction round the aperture in the shutter. A shallow frame is secured to the shutter just to receive this back extension of the camera, and so to avoid sideway leakage of light through the aperture in the shutter.

Even when a clear view of sky is available through the apparatus it is necessary to place a ground glass a few inches beyond the negative to avoid irregularity of the illumination due to clouds. Where the view includes buildings, trees, etc., the light must be obtained by a reflector fixed at 45 deg. to obstruct these latter, and to cast the light of the overhead sky on to the negative. The reflector is best of white blotting paper, renewed as soon as dirty, or, to save such renewals, flash "opal" glass, which is easily washed. Both are superior to a mirror for reflecting a diffused light on the negative. But I should mention a useful substitute for the reflector, viz., a sheet of ribbed glass placed parallel with and about two inches from the negative, with the ribs, about twenty per inch, on the side towards the negative and running horizontally. The ribs, on the principle of the prism windows used for dark offices, transmit the light largely in a horizontal direction, and, aided by a sheet of thin oiled paper midway between glass and negative, this plan (the suggestion of a "B.J." reader) yields a very even light.

For very dense negatives, or for those with much retouching in front or back, daylight has very positive advantages. In the one case it is a very actinic light; in the other its very even character

hinders such handwork showing unduly in the enlargement. Also in working from carbon transparencies, when making enlarged negatives, it is a very good light, but its constantly varying intensity makes it impossible to reduce exposure to a simple system. It is not difficult to test the light with an exposure-meter, drawing up a table of exposures for the various times of darkening of the meter-paper for an average negative and various degrees of enlargement, but that is one more operation, and may even be misleading if the light changes suddenly. For practical enlarging work, artificial light of some kind or another is by far the most satisfactory system, and the most popular apparatus in which to apply it is the enlarging lantern.

Features of Enlarging Lanterns.

An enlarging lantern is nothing more than an optical or magic lantern of extra long extension, and fitted with special devices for holding and moving the negative. The lens, unlike that of a projection lantern, requires to "work to focus," that is to render a sharply focussed picture as sharp on development. For this reason the lenses on most optical lanterns are useless for enlarging Fig. 7

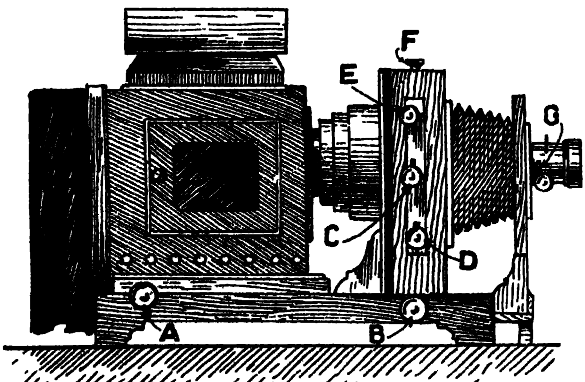

Fig. 7.—Enlarging Lantern. A, rack for lamp; B, rack for lens front; C, rack for rotating negative; D, for tilting, and E, for raising negative; F, set screw, holding negative carrier; and G, focussing movement of lens.

explains the chief parts, and Fig. 8 shows the form of the removable negative stage or carrier with which even cheap enlargers are now fitted.

In an enlarging lantern the light falls upon a condenser by which it is brought roughly to a point at the centre of the projection lens. This is what should result, though, in practice, by defect in the apparatus, or, designedly, for special purposes, it may not. But it is essential that the light should be movable to and fro from the

condenser; a rack and pinion movement is convenient, though the sliding lantern body is quite satisfactory.

The projection lens is moved to and fro by a rack and pinion, B. This mechanism in many enlargers is of a cheap, jerky kind, and is advantageously supplemented by a fine rack and pinion on the lens for final focussing. The "focussing mount," as fitted to the lens of a folding focal-plane camera, is excellent for this purpose as it is smoother than any rack and pinion.

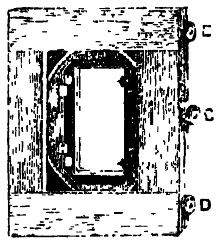

Fig. 8.—Negative stage with three rack-and-pinion adjustments of negative: C, rotating; D, tilting, and E, rise and fall.

As just stated, the main focussing movement of almost all enlarging cameras is by rack and pinion, but Messrs. Butcher, last year, introduced a decided improvement in a chain and sprocket movement. One advantage is its very smooth motion, but a greater is that the focussing head is fixed to the moving lens front. One can stand close to the easel when actuating it, and so tell very much better when the sharpest focus is obtained.

Of the movements of the negative carrier the most useful is that for rotating the negative. Usually one works the enlarging easel with a series of lines one within the other corresponding with the different sizes of bromide paper. One arranges the enlarged picture within one such space and then has a guide to securing the bromide paper in position. If the subject is not straight on the negative it is an easy matter to make it so in the enlargement by rotating the negative so that any vertical lines in it are upright within the space on the easel. It is much better and quicker to secure the result in this way than by leaving the negative straight in the lantern and placing the bromide paper askew on the easel. Another advantage of the rotating movement is that the picture of either an upright or landscape negative can be obtained the right way up on the easel. Some makers, in addition to the rack adjustment, provide a rapid movement from the vertical to the horizontal position.

Up and down movement of the negative is not such a useful feature. It necessarily shifts the negative out of centre with the condenser; and if the condenser is just the regulation size for the negative, e.g., 5½ ins. for quarter-plate, part of it will not be illuminated, will be cut off on the easel. The plan of raising and

lowering the lens on the front of the enlarger is worse, and wrong altogether. The lens should always be central with the condenser. If not, the illumination on the easel will be patchy (with shadows) in many circumstances. These defects will not apply when enlarging part only of the negative, the part being small in comparison with the condenser. In this case the up and down movement is useful, as it permits of bringing the part to be enlarged opposite the centre of the condenser. That is really the proper duty of the movement.

The third movement of the negative carrier is tilt—that is, instead of being perpendicular to the straight line running through the centre of the condenser and lens the negative can be angled to it The object of this is to make good the "drunken" appearance of pictures (mostly buildings) taken with the camera pointed upwards or downwards without the back (i.e., the plate) being swung to bring it vertical. Thus one's negatives decide whether this movement is or is not a useful one. In any case it is not a sufficient movement in itself. The easel requires to be angled also to the same extent. If it is not, the drawing will not be restored completely. The convergence of the lines can be removed by tilting the negative only, but without the easel movement the subject in the enlargement will be dwarfed (given a "squat" appearance) or stretched out into narrow formation according as the camera was pointed up or down when taking the photograph.

There are one or two further points to be noted as to the enlarging lantern. In some it will be found that the frame which carries the negative is made to fit the wrong way about, the back of the negative instead of the front coming against the rebate of the frame. This means that the exact position of the surface of each image (in enlarging a number of negatives) varies with the thickness of the glass of each. It is just as easy for the carrier to be mounted so that this is avoided, and sharpness can then be relied upon once a sharp focus has been obtained.

Another point is a means of holding the negative firmly in the carrier. The usual turn-button does not do this It is an easy matter to fit a spring clip which presses the negative against the rebate.

When buying an enlarger see that the negative is illuminated from corner to corner by the condenser as shown by the projection on the easel. Even though the condenser may be of ample size it may fail in this covering power owing to the distance between negative and condenser: the light converges after passing the condenser, and may thus leave the corners of the negative uncovered even when the latter is exactly central. Worse still, if it is raised or lowered.

Now that very small negatives are so widely used it is a convenience to have the negative stage in an enlarger movable to and fro within a few inches in front of the condenser. If there is not this movement it is not possible, with many patterns of the cheaper enlarger, to use, say, the lens of a vest-pocket camera for the enlargement of the negative.

The Light for the Enlarging Lantern.

Quite a number of different sources of light are available for the enlarging lantern. Choice is not altogether a matter of convenience and circumstances, for some lights yield better results for certain purposes than others, as mentioned in the notes in each case below. The chief lights are —

Oil lamp	Acetylene (flame).
Incandescent gas.	Acetylene (incandescent).
Spirit burner.	Limelight.
Electric incandescent	Electric arc.
Nernst.	Mercury vapour.

Oil Lamp.—Weakest of all the practicable lights, but best for very thin, weak negatives, for which purpose a professional enlarger will use it in preference to much more powerful lights A three-wick lamp is the usual oil light. A drawback is the image of the flame, which is liable to form on the easel In short, not a light for general use

Incandescent Gas.—The upright mantle burner is satisfactory for average work where negatives are not over-dense or to be enlarged on great scale, say, more than 6 diameters. The inverted burner can be used by reflection in a mirror placed an inch or two below the mantle, and at 45° to the axis of the lens. A good arrangement, this, as one works from the smaller, very bright tip of the mantle With the upright burner the pattern of the mantle will show sometimes. Preventive, ground glass, placed close in front of the light, or the lamp chimney may be ground As convenient and efficient a light as any.

Spirit Burner (*Mantle*).—A somewhat more powerful form of incandescent gas, but burning methylated spirit. Advantage of requiring no gas connection, but drawback of having to keep it going while the enlarger is in use, as some minute or two is required to start it again.

Electric Incandescent.—The ordinary pattern of metallic-filament lamp is useless, as the light is spread out too much, and it is most difficult to avoid the shape of the filaments showing in the enlargement. Recently "focus" lamps have been introduced which are free from these objections, and yield a perfectly steady light of about the strength of incandescent gas.

Nernst.—A first-rate and powerful lamp, particularly on high-voltage circuits (200 and over). Perfectly constant, but requires a large-aperture lens—not smaller than $f/6$, and better $f/4{\cdot}5$—otherwise it is impossible to obtain even illumination.

Acetylene.—The small acetylene flame—or rather three of them one behind the other—gives a very small, bright light much more powerful than incandescent gas. Readily turned up and down. Except for the drawback of involving the trouble of a generator it is a very good light.

Acetylene Incandescent.—A new method of using acetylene, in which the gas is burnt with air in a special atmospheric burner,

the hot non-luminous flame rendering a pastille white hot. In this form the light has "its back to the condenser," so to speak. It is reflected by a curved mirror, one-half only of the condenser being used, or in the case of some lamps the rays being brought to a focus without any condenser at all.

Limelight.—A blow-through lime jet supplies a very intense and concentrated light which is not much used nowadays, now that electric current is so readily obtainable, and compressed oxygen less so.

Electric Arc.—A small arc of the enclosed, semi-enclosed, or open arc type is the best all-round high-power enlarging light. It is very small, and thus does not easily give rise to shadows with a reduced aperture of lens: is very actinic, is instantly switched off and on, and requires but little attention. In the case of the enclosed arc, for some reason which is not clear, many lenses will show a sharp enlargement after focussing, but on development the picture will be out of focus. The only means of remedying this defect (which appears most with modern anastigmat lenses and least with R.R. lenses of the older type) is to shift the enlarging easel, for a distance found necessary, after focussing.

Mercury Vapour.—The most perfect of all enlarging lights for use on a commercial scale, owing to its absolute constancy and evenness of illumination. The latter (when three short tubes are used) is such that it is not necessary to use a condenser, and thus the largest negatives can be dealt with. But one would hardly include it among the lights for amateur use, since the cost of the tubes and the space they occupy are objections when enlarging is done only at odd times instead of as a regular daily business. Reviewing what has been said, about the best light, where electric current is available, is a small arc; next to that either a Nernst or a special metallic-filament lamp for lesser power work. Next in order of preference I should place incandescent gas, and as about equal in convenience a spirit burner and acetylene, or, perhaps, the latter first of these last two now that dissolved acetylene is so widely obtainable from motor depôts.

The Condenser in Use.

As the lantern is the most popular form of enlarging apparatus, I will deal with its use somewhat at length, particularly as much to be said in regard to it applies only to it, that is to the employment of a condenser. It must be borne in mind that the condenser makes a considerable difference. The condenser transmits the rays of light from the lamp as a converging beam, which should come to a point in the projection lens. Theoretically, the condenser causes the rays thus to converge at the stop of the projection lens. In practice there are several reasons why it does not do this. For one thing, the source of light is not a point, but is of some size; and, in the case of a light such as the incandescent gas mantle or the Nernst lamp, of considerable size. For another, the condenser, as fitted to enlarging lanterns, does not bring the rays of even a point-form of light again to a point. But it does converge the rays to a very consider-

able degree, and thus the projection lens has transmitted to it a larger volume of light than would be the case were the condenser not used.

The point of the cone of converged rays is small enough to have one important effect: it passes through a lens-diaphragm of relatively small size, and hence, when a condenser is used, the exposure may be as short at *f*/8 as at *f*/6 or *f*/4.5. This applies specially when using small sources of light such as the arc or limelight. With larger sources, such as incandescent gas or Nernst filament, the point of the cone is larger, and it does not do to use a projection lens of small aperture, since then it is difficult to obtain a clear, evenly illuminated disc from the lantern (without a negative in it).

Also the light requires to be adjusted as regards distance from the condenser, for each different degree of enlargement. While the distances of the projection lens from the negative and the sensitive paper follow a definite optical rule, and, if necessary, can be calculated with reasonable correctness, the varying distances of the condenser from the source of light are not susceptible to such calculation. It is a matter for adjustment by trial and observation upon the screen without a negative In thus making the enlarging lantern ready for use much time is saved by working on a definite system.

The Enlarging Lantern in Use.

Having lighted the lamp, the first thing is to insert the negative and adjust the position of the focussing easel and lens front of the enlarger so that the enlargement is of the required size and roughly in focus.

At the same time the light is roughly adjusted by moving it to and fro and roughly centering it. Then remove the negative, and adjust the light to a nicety so as to give an evenly illuminated disc without further moving the projection lens. Some shadows are almost certain to be seen in the disc. Best to draw the lamp a little forwards or backwards so as to give marked shadows, then to centre it so as to cause the shadows to be placed symmetrically on the disc and then to move the light backwards or forwards until the shadows disappear altogether.

Then, for exact focussing, insert in the negative stage a test plate, such as an old negative, with fine needle scratches on it, or one of the ruled glasses sold for the purpose. A very slight movement of the lens pinion, or that of the enlarger front, will secure perfectly sharp focus Then replace the test plate by the negative, place an orange or ruby cap on the lens, pin the bromide paper in position, and make the exposure.

I am assuming that you are using the ordinary vertical board of the enlarging easel Of this, and of modifications of it, I write in a later paragraph. Here it suffices to say that it is necessary to use ordinary care not to push it out of position when pinning the bromide paper to it.

In describing the movements of the enlarging lantern I referred to the tilting of the negative (as viewed edgewise) for correcting distortion caused by upward or downward angling of the

camera without the use of a swing back when taking the subject. When the negative is so tilted in the enlarger, the easel requires to be tilted to an equal degree. What this degree requires to be for exact correction cannot readily be ascertained; one can go only by the look of the enlargement. This tilting of the negative, too, usually requires a smaller stop to be used in the lens in order to obtain all parts of the subject in sharp focus And this often leads to a further difficulty, as follows :—

As I mentioned in a previous paragraph, the use of a small-aperture lens and a small stop in a large-aperture lens causes shadows on the screen, particularly with light-sources of large sizes. In such cases often the only remedy is to diffuse the light, and the best way to do that is to place a screen of ground glass as close to the light as can conveniently be done With incandescent gas it is sometimes found sufficient to grind (with emery powder) a patch on one side of the glass chimney. But whatever the screen, place it as near to the light as you can; that is better than against the condenser, and much better than between the condenser and the negative.

Such diffusion of the light is also necessary when enlarging negatives which have retouching on them (See later) Often, too, it is the only remedy for the pattern of the gas mantle showing in the enlargement

Enlarging by Direct Light Without Condensers.

A condenser. as I have said, is the readiest means of illuminating the negative for regular enlarging work, but it is not the only. or indeed the best, method when using artificial light. Usually, however, the condenser is dispensed with only when enlarging is done at infrequent intervals, or when apparatus has to be extemporised from other accessories which are available. In the absence of a condenser artificial light may be utilised in one or other of two ways, either direct or by reflection. The former is the less satisfactory plan, but I will give one or two useful methods here.

Magnesium ribbon supplies one means which at times may be of service in illuminating a negative. The latter is placed in a camera as used for daylight enlarging, and of the type of either Fig. 4 or Fig. 6. About two inches behind it a sheet of ground glass, or flash opal, an inch or two larger each way than the negative, is fixed. The magnesium is burnt about 2 inches again behind this diffusing screen. The chief point is to secure even distribution of the light, which can be done by moving the burning ribbon to and fro over the length of the screen, gradually lowering it from top to bottom. The ribbon is fed out of a glass or metal tube as it burns, and with a little dexterity it is easy to burn the several feet which usually are necessary without interrupting the burning. A more convenient plan, however, is to hang up strands of the ribbon at intervals of about half to one inch across a frame behind the diffusing screen, and to burn these in succession. For negatives up to about half-plate size this is a quite practicable method, with the drawback of the magnesia smoke and the awk

wardness of having to burn a full dose of the ribbon in order to test the correctness of exposure.

In using direct light for larger negatives it is not much use considering anything less powerful than an arc or incandescent half-watt lamp such as is used for studio portraiture, placed considerably further from the negative and likewise diffused by a sheet of flashed opal placed between it and the negative. I

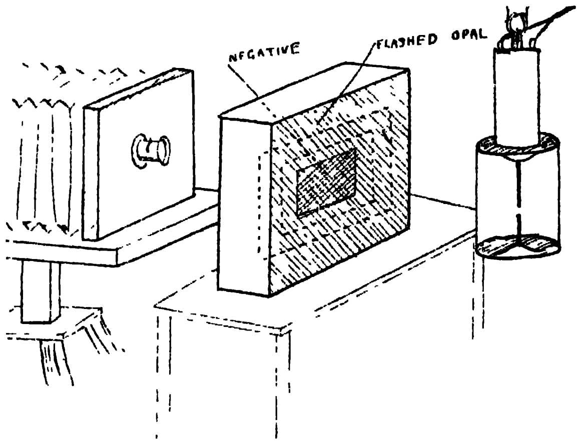

Fig. 9.—Enlarging with direct light from arc (or high power half-watt) lamp, diffused through flash opal. The camera partly shown on left carries a dark slide for the bromide paper.

reproduce a drawing of such an arrangement used by Mr. A. Handford. If 12 x 10 is the largest size from which it is required to enlarge or reduce, a box should be made 18 in. square and 5 in. deep. In the "top" is fitted a set of carriers from 12 x 10 down, and in the bottom a sheet of flashed opal, the full size, 18 x 18 inches. The negative is put in the carrier, the box stood on end, and the arc lamp lowered until level with the negative. It will be perfectly illuminated, even if the arc is within a foot of the opal, and, like other such systems, has the advantage of yielding enlargements freer from grain than those made with a condenser.

Enlarging by Reflected Artificial Light.

But where artificial light is used without a condenser the better plan is to employ it by reflection. With lights of moderate power, such as incandescent gas, it has its limited uses as regards the size of the negative which can be evenly illuminated and the degree to which a somewhat dense negative can be enlarged, but it is nevertheless an exceedingly serviceable method. The apparatus on the market may be divided into two classes—(1) moderate power

illuminators, such as those of Messrs. Hughes, of Kingsland, London, N., and Messrs. Lancaster, Birmingham. These consist of metal chambers fitted with incandescent gas or electric lamps, the light from which is reflected from a white curved surface. Fig. 10

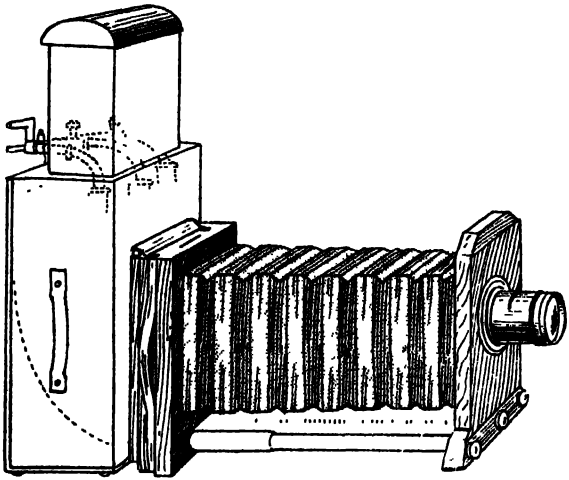

Fig. 10.—Illuminating chamber, attached to ordinary double extension camera, converting it into an enlarging lantern.

shows such a chamber and how it is used in conjunction with an ordinary double extension camera, the two together forming an enlarging lantern. For negatives up to about half-plate in size this system works very well—as well as a condenser—so long as the negatives are not of great density nor required to be enlarged to a great degree—say, more than 7 or 8 diameters. As the light is reflected, and as it is not condensed as in an ordinary lantern, the "power" of the system in this form is less, but for anyone who has a suitable camera it affords a very inexpensive and convenient means of converting it into an enlarging lantern.

(2) High-power illuminator by reflection. The second commercial form is perhaps best represented by the apparatus of Messrs. Marion, two drawings of which are shown in Figs. 11 and 12. Fig. 11 is a front view of the exterior showing the nest of carriers to hold negatives of any size from the largest to the smallest. A shelf, not shown, permits of a camera being placed centrally against the negative. The back wall of the box inside is a white surface, which is very strongly illuminated by a pair of arc lamps, placed one each side of the carrier opening. Fig. 11 is a view looking from back to front of the box. No doubt half-watt electric lamps of high power may be used in place of arcs. An apparatus of this kind serves not only for enlarging, but for reducing (as when

making lantern slides from large negatives) and for copying. In the latter the original is pinned to the back wall of the box, or rather to a *black* board placed over it.

For enlarging there is, of course, no particular virtue in the box, except that it provides a light-tight receptacle for the light, and thus allows of the enlargement being received on an unenclosed easel in the dark-room. But if a daylight enlarging camera is available the system can be adopted simply by screening a pair

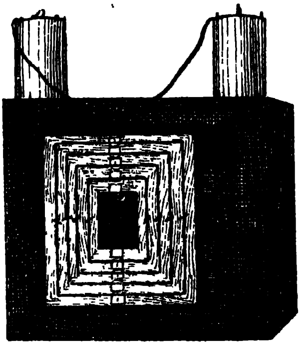

Fig. 11.

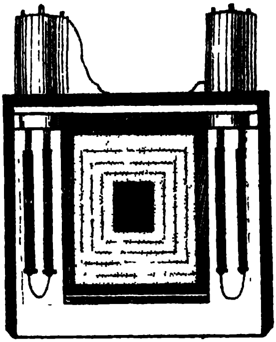

Fig. 12.

Fig. 11.—Front view of arc reflector-illuminator box, for use with ordinary camera as enlarger.

Fig. 12.—Interior of box, as seen from the back, which receives (and reflects through the negative) the light from the arcs.

of arcs or high-power half-watt lamps on the side next the camera and placing a white screen—nothing better than white blotting paper pinned to a board—to illuminate the negative. Focussing, vignetting etc., are so greatly facilitated by having the enlargement unenclosed in a camera that the boxing in of the light instead of the sensitive paper is by far the more advantageous system in practice.

VERTICAL ENLARGERS.

In the early days of photography, when papers were enormously less sensitive, it was usual to use direct sunlight for enlarging, and hence "solar enlargers" were built vertically and made, heliostat fashion, to receive the directly perpendicular rays of the sun. For quite other reasons nowadays there is much to be said for a vertical pattern of enlarger for amateur use. The chief advantage is that it avoids the great floor (or table) space required by the ordinary horizontal enlarger, of whatever pattern. A vertical enlarger can be kept standing ready for use in the corner of a room, and occupies a floor space which need not be more than about 2 ft. by 2 ft. Also the construction is greatly simplified since condenser and negative require only to *rest* on shelves, instead of being supported in

holders. Again, the sensitive paper may readily be laid in register with the projected enlargement, and held in place merely by turning down a sheet of glass (hinged) upon it. Against these advantages is the unwieldy height which the apparatus assumes when enlargement is more than about four times with a lens of normal focus—say 6 ins. for quarter-plate negatives. For amateur purposes four times (a 15 by 12 enlargement from a quarter-plate) is usually sufficient. If a greater degree of enlargement is required it is usually to secure a 15 by 12 picture from a small portion of a negative, for which purpose a 3-in. focus lens may be used within the limits of height prescribed for a 6-in. lens and four-times enlargement.

Several practical workers have written in praise of the vertical enlarger, notably Dr. H. D'Arcy Power, of San Francisco, who has described the conversion of a cupboard with a skylight into a daylight enlarger of this type, and the use of supplementary spectacle lenses for securing a fair range of degrees of enlargement without making the enlarger unduly tall ("B.J.A.," 1910, p. 583). A simple form of vertical enlarger using artificial light was described by another San Franciscan, Mr. Carl Thayer ("B.J.," October 11, 1912, p. 781), and a few months ago, as recorded on another page in the Epitome section of this "Almanac," an English worker, Mr. H. Bamford, described a home-made vertical enlarger used by him for commercial enlarging. These references will be sufficient to instruct those interested in constructing an enlarger of this kind, as to the lines which may be followed according to circumstances.

The Lens for Enlarging

Broadly, the lens with which a negative is taken is a suitable lens with which to enlarge it. This applies to camera outfits fitted with a fairly decent lens, that is the sort of lens which is good enough to be sold separately. It does not apply to the very cheapest kinds of film or plate-cameras, many of which are supplied with lenses which do not work at a larger aperture than $f/16$. But if the worker has a decent "rapid rectilinear" lens of $f/8$ aperture and focal length about 10 per cent. longer than the long side of the plate, that will be a very good lens for enlarging from the negatives.

In the case of daylight enlargers or other apparatus in which no condenser is used, the focal length of the lens has the effect only of determining the size of the apparatus. With a 10-inch lens the distances from negative to lens and lens to paper are twice those when a 5-inch lens is used. And there is no object in using a longer focus, though no disadvantage except that of unnecessary length of the camera.

But in the case of an enlarging lantern (with condenser) the focal length of the condenser is chosen roughly to work best with a lens of a particular focal length, *e.g.*, 5 to 6 inches with a condenser for quarter-plate negatives, and 8 to 9 inches for a half-plate enlarging lantern. It is not advisable to use focal lengths very different from these.

As regards the type of lens, there is very little, if any, advantage in using an anastigmat of aperture larger than $f/8$ in circumstances

where this aperture is large enough. But, as already stated, some sources of light, *e.g.*, Nernst lamps, call for a larger aperture. Then an anastigmat, on account of its *f*/6 or *f*/4.5 aperture, is necessary. On the other hand, the R R. type of lens is better for use with the enclosed arc light for the reason that with it the nuisance of want of coincidence between the sharpness seen on the enlarging easel and that obtained on the print is much less prevalent than with modern anastigmats. In other respects, too, the R.R. is preferable. Its diaphragms are often of metal—invariably in the case of the detachable Waterhouse stopes, and often so when iris diaphragms are fitted. Many anastigmats, however, have ebonite iris diaphragms, which, in the focus of the arc lamps, may be destroyed.

For certain purposes it is an advantage to use a lens which does not yield really sharp definition. Usually, of course, one's aim is to make the enlargement as sharp as possible, but sometimes this quality may be a defect--*e.g.*, in the case of retouched portraits—and then a lens which gives a pleasing degree of softness of definition is a positive advantage. The Dallmeyer-Bergheim lens or the Dallmeyer portrait lens (set to give diffused focus) have been thus applied with very satisfactory results. It is not suggested that one will buy them for use in enlarging, but, having them, one can turn them to good use and so obtain softly diffused enlargements more easily than by other methods mentioned in a later paragraph.

The Enlarging Easel.

Practically the only remaining part of the enlarging outfit is the easel or support for the sensitive paper. The simplest form is a plain upright board fitted to a heavy foot. It should preferably be guided by a base-board of some form, so that wherever it is placed the surface of the easel comes automatically at right angles to the straight line through the centre of the lens A pair of boards about half-an-inch apart, with a strip secured to the underside of the easel foot, is one such base-board. Another is a pair of boards, each of Λ-section, the support of the easel having a pair of Λ shaped slots cut in it.

The heavier the whole easel the better, as it will not be liable to be moved when pinning the paper to it. A great preventive of accidental shift when fixing up the paper is to cover the easel with "cork lino," the cheap linoleum sold for floor coverings. It is readily attached with hot glue and is practically everlasting. The sensitive paper is readily pinned to it with very light pressure of the pins.

As means of saving the trouble of pinning, and at the same time of ensuring perfect flatness of the paper, a number of special patterns of enlarging easels with glazed fronts have been designed, of which my own preference is the "Westminster," which is of the hinged type. By adjusting the easel up or down, or by a rotating movement, the picture is placed within one or other of the rectangular spaces marked on it. The easel swings into the horizontal position and the paper is then laid in place within the prescribed space, the easel brought back to the vertical position and the

exposure made. One other advantage of a glazed easel of this kind is the readiness with which a black mark can be laid in close contact with the paper, and the enlargement then obtained with perfectly "square" white margins. This is a great help in trimming the enlargement, or, if desired, the print can be finished off with a narrow white border by trimming all round a fraction of an inch short of the picture itself.

Before leaving the easel I should mention the use of a rapid printing machine where a large number of enlargements of moderate size require to be taken off. Some few of the many rapid printing machines are made to hold the paper vertical, and where this is

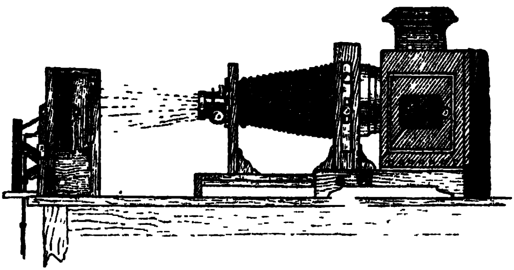

Fig. 13.—A rapid bromide printer of the vertical pattern, used as enlarging easel when making a number of enlargements from one negative.

the case it is an easy matter to use the printer as an enlarging easel. Fig. 13 shows the "Hana" machine thus adapted simply by removal of the front portion containing the light; no negative, of course, being used in the printer. Thus arranged, any number of enlargements can be made with no loss of time in placing each piece of paper in position.

The Negative for Enlarging.

It is not much use saying much in the endeavour to describe the type of negative which is best for enlarging purposes. A little experience will soon show what it is. But it may be said that for the best results a thin, rather soft, but brilliant negative is needed —the kind of negative which is a quick and good printer in P.O.P. Softness of gradation alone (as is obtained when an over-exposed plate is fully developed) is not sufficient in itself to yield a perfect enlargement. Such a soft but thick negative shows its inferiority in enlarging more than in contact printing, in consequence of the scatter of light which takes place from all parts of the silver deposit.

Then again much depends on the strength of the light used in enlarging. When a powerful light such as the arc is used the negative may be of greater contrast, whilst on the other hand a flat, thin, over-exposed and under-developed negative will yield a passable enlargement only by using a weak yellowish light such as an oil lamp.

I have already referred to negatives with much pencil retouching on them and to the necessity in their case of using a highly diffused light—daylight for preference, or, when an enlarging lantern is used, with ground glass between the light and the condenser. In some cases, chiefly portraits, it is an advantage to put the enlargement slightly out of focus or to use a soft-focus lens as advised in an earlier paragraph

CHOICE OF PAPERS.

In comparison with a few years ago enlarging work is greatly facilitated by the wide range of bromide (and gaslight) papers available. Apart from the surface—which now runs from glossy to a coarse linen-like grain—the user can turn to great advantage the different degrees of contrast which obtain with different makes of paper and with different grades of the same make The range is too wide to make it possible to particularise, for the last year or two have seen it extended by the introduction of development papers intermediate in speed between bromide and gaslight papers and approximating in some cases as regards vigour of image to the papers of the latter class

EXPOSURE

A little system, but not too much of it, is of great service in ascertaining the time for the exposure of the enlargement. By that I mean that the most useful test is the exposure of a small trial strip of paper, but a little system in the form, chiefly, of particulars of exposure under certain conditions will afford a most valuable aid in enabling one to come pretty near the right exposure when exposing the test piece. It must be borne in mind that rules and tables do not necessarily apply to enlarging both by daylight and artificial light. The use of a condenser upsets certain rules which the worker may perhaps unwittingly apply to it Let us take daylight enlarging first.

Exposure in this case depends on—

1. Density of negative
2. Strength of light.
3. Aperture of lens.
4. Degree of enlargement
5. Speed of bromide paper.

Where the advised system comes in is in the working out by trial (on small pieces of paper) of the correct exposure under certain conditions as regards factors 1 to 5.

In respect to the negative it is a good plan to choose and keep at hand one fairly representing your average make as regards density and absence or presence of stain. Any negative to be enlarged can then be compared with it, and from ordinary experience in contact printing it is not difficult to judge that it will require half, double, or four times the exposure required when the standard negative is used.

Strength of light is readily tested by an exposure meter such as the Watkins or Wynne, noting the number of seconds required to

reach the standard or quarter tint according as the light is strong or weak. You must, of course, stick to one tint or the other, or else make allowance for the change. The exposure meter thus tells one if the light is more actinic than that of, say, a tint time of fifteen seconds, which we may choose as our standard time. If the actinometer records thirty seconds we allow twice the exposure as regards this factor.

Aperture of lens follows the rule inversely as the square of the *f* number as in ordinary photography.

The greater the degree of enlargement, the longer the exposure required in a definite ratio which is embodied in the table of "Relative Exposures when Enlarging," included among other optical tables later in this "Almanac."

Speed of papers may be seen from the speed card of the Watkins Meter Co.

Assume, then, that with our standard negative in a light registering 16 on the actinometer with *f*/8 lens and enlarging 4 diameters (*i.e.*, quarter-plate to 15 by 12), it is found that 20 seconds are required on Wellington bromide paper Let me illustrate the use of this verified record in other unknown cases :—

	Factor.
Negative—judged to be twice as dense ..	2
Light, 7 to 8 Wynne .	½
Lens aperture *f*/5.6	½
Degree of enlargement, 8 times	3½
Paper—Illingworth	1

That is, the time of exposure is 20 x 2 x ½ x ½ x 3½ x 1 = 35 secs.

Long as it takes to read and describe, this system requires only a minute or two in practice. I give it as the readiest means I know of judging with fair approximation what the exposure will be. In practice it will be simpler than here shown, for the bromide paper and the lens aperture will be the same in most cases.

Now, as regards exposure with an enlarging lantern. Here factors 1, 2, 4, and 5 apply as before, but not factor 3 (aperture of lens), for reasons which have been explained above. Therefore, you must leave out factor 3, and usually you can also leave out factor 2, as the light is the same in the case of each exposure. Even if it is not, there is no easy way of measuring it. The system is thus shorter when using artificial light, and if, for any reason, you have to use a stop smaller than that in the standard conditions,* well, neglect it altogether if the condenser is used plain and the enlarger is adjusted as directed in a previous paragraph. If a diffusing screen is used in front of the light one may suggest doubling the exposure for each doubling of the *f* number—*e.g.*, twice the exposure for *f*/8 when the standard conditions specify *f*/5.6. This is a rough approximation—it is not possible to be even approximate—but let me repeat that I recommend the system here described solely as a means of ascertaining the exposure for the test strip

* This should be the full aperture of the lens.

If experience shows it to be exact enough for the test strip to be dispensed with, well and good, but obviously in the absence of a reliable measure of the density of the negative it cannot pretend to be that.

Unsharp Enlargements.

The chief causes of unsharp enlargements are as follows :—

Lens out of centre with the negative—due to undue use of rising and cross front of the enlarging lantern, and most likely to occur when using a lens which is of short focus relatively to the negative being enlarged. In such circumstances it does not do to move the lens (or the negative) out of centre with each other.

Negative loose in its carrier, or negative does not register with the test plate used for focussing.

Buckling of the paper after pinning to the easel.

Vibration of the apparatus during exposure, or shifting of one part after enlargement has been focussed.

Dust or condensed moisture on lens.

Bad adjustment of the light. The light requires to be adjusted afresh when the scale of the enlargement is changed.

Want of register between the visible and chemical image—occurring particularly with the enclosed arc light, and varying greatly with different lenses.

Soft Effects in Enlargements.

For pictorial purposes it is often an advantage to utilise certain means of purposely introducing a certain want of sharpness into the enlargement. In portraits, the effect of softening out sharp lines is often a great improvement, and in landscape subjects such methods are of service, particularly in the case of subjects which include heavy masses of shadow, the latter being thereby broken up and relieved of their solid monotonous effect in the enlargement. The most usual method is the use of "bolting silk," obtainable from any large photo-supply house, stretched on a frame and placed at a distance in front of the sensitive paper, which depends on the degree of breaking up required and on the actual distance from lens to paper The screen should never be close to the paper, as the effect is then simply to impress the pattern of the silk too insistently on the enlargement. Three or four inches away is a fair distance at which to try the effect, and usually it is a good plan to use the screen for only half the whole period of exposure, as can readily be done when using an enlarging lantern

A delicate softening of the image—less marked than by the use of bolting silk as described above—is obtained with chiffon, using two thicknesses of this material strained over a collar to form a cap for the lens. With both bolting silk and chiffon, the enlargement is, of course, focussed sharply with the unscreened lens, and the fabric then introduced for the exposure.

Of the use of a special lens or specially adjusted lens for producing "soft-focus" effects mention has already been made in the paragraph on "The Lens for Enlarging."

Vignetting and Shading Enlargements

Except for portraits, vignettes are rather out of fashion at present, although there is no reason why they should be, for the delicate shading off of the subject into a white margin is most effective in many cases. For practical purposes vignetting is possible only when there is a clear unobstructed space between the lens and the enlarging easel, as when using an enlarging lantern and employing daylight admitted from a window in a darkened room. The vignetted effect is produced by interposing a card (in which is cut an aperture of the shape desired in the vignette) between the lens and the sensitive paper. The card must come a fair distance from the paper, otherwise the vignette will be too abrupt, and it should be moved to and fro within a short distance during exposure. The aperture needs to be small in comparison with the enlargement: usually the tendency is to cut it too large, for the cut-off of the light is less in the developed enlargement than it appears on the enlarged (negative) picture on the easel. However, a fair idea can be formed of the vignetting effect, and the vignetting card placed in position in readiness for exposure. For this, a very convenient means is some lead wire of about one-eighth inch diameter, one end of which is coiled round a short upright fixed in a firm base, whilst the other is twisted into a loop to clip the vignetting card. The advantage of the lead wire is that it is destitute of spring, and so allows of the card being placed to a nicety in any position without recoil and without tendency to move unless again adjusted. When the cap is removed the base of the vignetter is steadily moved to and fro in a straight line within narrow limits, for which purpose it is an advantage to have a guide bar on the baseboard of the apparatus.

But the more frequent use which can be made of a shading card—which is all that the vignetter is—is in controlling the exposure of different parts of the paper. The sky is the most usual example. In most negatives in which the natural clouds are rendered the sky portion is so dense as to require several times the exposure of the rest of the subject, and therefore the part of the subject below the sky-line on the enlarging easel is shaded by a card held between lens and easel for a period which will often be two or three times the period required for the landscape portion. If the horizon line is fairly flat a straight card moved up and down a little as well as to and fro during exposure will suffice, but if objects project from the landscape into the sky it is an easy matter to cut a rough mask. Another fairly common case is where some part of the subject is thin and lacking in detail, resulting in a heavy clogged patch in the enlargement. Here a card can be used to shield this portion during a considerable part of the whole exposure; or, when the position of the dense portion within the negative requires it, an opaque patch can be mounted on a sheet of glass which is used as the shading card. In fact, the perfect negative which can dispense with any shading during exposure is somewhat of a rarity. Indeed, some workers have carried local control of the enlargement during exposure to quite a pitch. I instance Mr. T. H. Greenall, who mounts a clear glass in a pair of grooves about an inch or so from the bromide paper, works on the glass transparent water-colour and opaque to register roughly with the enlarged picture.

In all vignetting and shading work it is necessary to adjust matters so that the exposure is of a fair length, say twenty seconds, otherwise it is difficult to use the shade for a part of the time only with anything like exactness. If the exposure with the lens at full aperture is too short it is better to increase it by inserting ground glass behind the condenser or by using a slower paper than by stopping down the lens. The latter plan, when a condenser is used, is apt to upset the proper illumination of the enlargement.

CLOUDS IN ENLARGEMENTS.

Landscape subjects in which the sky is a plain white expanse require the addition of clouds far more urgently in an enlargement than in a contact print. Fortunately the printing-in of a sky is an easier matter in enlarging than it is when contact-printing on development papers. The methods which can be followed are chiefly three :—

1. Single development—exposure, first of the landscape, then of the cloud, followed by development of the whole picture.
2. Double development—exposure of the landscape, development, exposure of the cloud, followed by development of the whole picture, or of the sky only.
3. Making a composite transparency of landscape and sky, and from this preparing a new (same size) negative for enlarging or enlarged negative for contact-printing.

Method No. 3 is really the making of an enlarged negative, and is therefore dealt with in the chapters on this branch of work, but it is the most certain method, and the best when several enlargements with clouds are required. To turn, however, to Methods Nos. 1 and 2.

Single Development.—The first thing to do is to focus the image of the landscape negative on the enlarging easel in the usual way, save that a shield of thin card is pinned up to receive it.

On this card, trace the sky line of the landscape with a pencil, take down the card and cut it into two pieces along the pencil line with a pair of scissors or a sharp penknife. One part A, representing the landscape, forms a mask for use when exposing the cloud negative; whilst the part B, representing the sky, may be required when exposing the landscape negative, that is if the density of the sky in the latter is not sufficient to give a clear unexposed area on the bromide paper.

These two masks being made, the bromide paper is pinned up and the proper exposure given. In the cases of nine negatives out of ten it is not necessary to shield the sky portion, but if the sky is thin enough to print, Mask B is held close in front of the bromide paper and kept in very slight movement with the cut-out outline approximately in register with the image on the paper.

Now replace the orange cap on the lens and, with a soft lead pencil, faintly trace the sky-line upon the bromide paper.

Without moving the paper, replace the landscape negative by that of the cloud in the lantern and, with the orange cap still on, adjust the image of the cloud in place, guided by the pencil line.

Now bring Mask A into rough register a very short distance from the paper and make the exposure for the cloud negative, keeping the mask in slight up-and-down movement. The exposure will rarely be the same as for the landscape, and usually it will be less. It is necessary to ascertain the correct time for each negative by preliminary trials with small pieces of paper, developing each pair together for the same length of time.

The whole picture is now developed, when cloud and landscape should be obtained without any sign of join. Usually the clouds are of much lighter tone than the landscape, and therefore any error in adjustment of the mask may better be in the direction of overlapping than of leaving an unexposed line above the edge of the landscape.

Double Development.—In this method essentially the same plan is followed except that the landscape is developed up in order to show exactly where the mask must be held when the exposure is made for the cloud.

The landscape negative is first exposed, developed, and washed (not fixed) for a quarter of an hour, and the wash water removed from the surface by mopping with a chamois leather. The print is then pinned up to the easel, the cloud negative having meantime been inserted in the lantern. With the orange cap on the lens, the cloud is adjusted in position, the mask A adjusted to shield the landscape, and the exposure made for the cloud.

It must be remembered that the development and washing of the paper reduce its sensitiveness some three or four times, and therefore allowance must be made in the second exposure. A separate test on one or two small pieces of paper is required in order to find once for all the degree of slowing for a given time of development and washing. In making this test it is well to allow the developer long enough to act as much as it will; in other words, to develop to the full and to do the same when developing the landscape. We thus make sure of landscape and cloud coming up equally. If development is not full in the first instance (the landscape) it will gain in depth when the cloud is developed; and though it is fairly easy to apply the developer to the sky portion only, the colour of the two parts is liable to differ slightly in these circumstances. Moreover, full development (as far as it will go) is the proper course when enlargements are to be toned, as many are, by the sulphide-bleach method.

It is beyond the scope of this monograph to go into the selection of a cloud negative to harmonise with the landscape. Apart from the avoidance of conflicting schemes of lighting, a safe rule is to shun overpowering cloud effects. Usually the quiet skies such as one sees in autumn are more useful than the striking cloudscapes of early spring, and apart from harmonising in tone and lighting with the landscape, the lines of the cloud forms can do a great deal in contributing to the balance of the composition.

Enlarged Negatives.

A whole article might be devoted to the many different methods which have been advocated for the making of enlarged negatives.

Broadly, the methods differ in value, first, as regards the quality of the result, and, secondly, in the degree to which they permit of hand work being carried out at various stages. A method, too, which is good enough where the intention is to make gum or similar prints of "broad" character is not good enough when the quality of the original is to be retained as far as possible. In general this quality is preserved by working throughout by transmitted light—that is, making a positive transparency on glass from the negative, and from this preparing the enlarged negative. In carrying out this process the method may vary, but usually follows one or other of the two following systems:—

Alternative Methods of Making Enlarged Negatives.

I.—A same-size positive transparency is made from the negative—

(1) on a dry-plate; or
(2) by the carbon process,

and is enlarged directly—

(*a*) on to a dry-plate;
(*b*) on to bromide paper.

II.—A positive transparency of the required degree of enlargement is made—

(1) on a dry-plate,

and from it a negative is printed by contact or by same-size copying in the camera—

(*a*) on a dry-plate;
(*b*) on bromide paper;
(*c*) on carbon tissue.

Method I.-1-*a* is the most usual process, as it is quick and can be done throughout at night.

Method I.-2-*a* is preferred by some for the reason that the carbon transparency is a more automatic means of retaining the quality in a negative than is the dry-plate

Method I.-1-*b* is convenient for those who don't mind sacrificing some quality of reproduction for the facility of working up the enlarged paper negative. The latter at its best is somewhat inferior to a dry-plate enlarged negative at its best, but, of course, is much cheaper and lighter.

Method II. in its various forms is more costly, since two large plates are used, but appeals to those who wish to carry out hand work at both stages. The method is certainly the best when making a composite enlarged negative of landscape and sky, as described below.

With these general indications of the scope of the various processes we can come to practical details, taking first the method (I.) of making a same-size transparency and enlarging from that on to plate or paper.

Dry-Plate or Carbon Transparency.

Much discussion has raged around the making of the transparency. Most workers prefer to make it on a dry-plate, but differ among

themselves as to whether a rapid (negative) plate or a slow (lantern) plate is better. Others, again, among them Mr. Jas. H. Sinclair is prominent, advocate a transparency by the carbon process. The truth is that much depends on the character of the original negatives as well as on the use which is to be made of the enlarged negatives. If the original negatives are of a kind suitable for enlargement, thin, clear, and brilliant, without being hard, then undoubtedly the carbon transparency is the surest method of retaining these qualities in the enlarged negative. And this method is particularly suitable when the enlarged negative is to be printed in platinum or carbon, and thus requires to be of a fairly vigorous character. But, on the other hand, the dry-plate, as a means of producing the transparency, possesses greater latitude, is less automatic. It allows of very great variation being made as regards contrast, and thus permits of correcting a flat or hard negative in making the transparency from it. It is true that much in this direction can be done when enlarging from the transparency, be this latter on a dry-plate or by carbon; but on the score of expense it is obviously better to carry out such corrective trials in the small instead of the large size. The dry-plate certainly has the drawback that it is not easy for the beginner to tell when he has made a transparency of the right kind. It is easy for him to make any (wrong) sort of transparency until he has learnt to judge what is wanted and knows how to obtain it.

Making the Dry-Plate Transparency.

In making the dry-plate transparency the most common fault is to get it too hard. Many workers have made lantern plates, and first fall into the error of producing a similarly brilliant positive. What is really wanted is a positive which looks wretchedly flat and veiled as compared with a good lantern slide. The darkest parts (shadows of the subject) should be only so dense that type can be easily read through them when the transparency is placed on a printed page; whilst the high-lights should nowhere be clear glass, but be covered with a slight deposit. This is the appearance which the transparency should have. It should be the result of ample exposure of the plate supplemented by the use of a non-fogging but fairly quick-acting, i.e., soft working, developer.

As regards the choice of plate, those of the "lantern" or "transparency" type will yield this result, but they are made for the utmost clearness of the high-lights, and therefore the tendency, when they are used, is to get too brilliant a transparency. For this reason it is better to use a fairly rapid negative plate, say of about 200 H and D., the easy and natural result with which, when treated as above described, is free from undesired sparkle and brilliance. At the same time, it need not be forgotten that there are cases—where the original negatives are wretchedly flat—in which it is best to use a transparency or, better, a "process" plate, and to seek to enhance the contrast of the original. In making the contact transparency on a rapid dry-plate the exposure will be very short—a second or two by the light of a candle placed several feet away.

A very useful accessory in making such exposures is a printing frame sold by Messrs. Marion, in which by a series of shutters four or five different exposures can be given on the one plate.

As regards making the transparency by the carbon process, it is not necessary to go into the manipulation, since this is simply that ordinarily followed in making transparencies on the tissues specially supplied for the purpose

The Enlarged Dry Plate Negative.

The next step is to enlarge the positive transparency, as though it were a negative, upon a dry-plate, or, if a paper negative is to be made, upon the special "negative paper" sold by some few makers, or upon a suitable bromide paper. If by the carbon process, the transparency must be illuminated by diffused light—that is, ground glass placed behind the condenser—otherwise markings due to the relief of the carbon image make themselves evident.

The plate for the enlarged negative is best a slow "landscape" dry-plate of speed about 40 H. and D. A plate of this kind works very cleanly, has very considerable latitude in exposure (more than a lantern plate) owing to its thicker emulsion coating, and is not inconveniently fast or slow. For the development, use any formula to which you are accustomed, for in the longer or shorter time of development of the enlarged negative you have the most useful means of obtaining the contrast or softness which you want. Metol hydroquinone is a good developer, but those who like negatives with a little yellowish stain in them can use pyro-soda

Paper Negatives.

In making a negative on paper it is necessary to realise that the requirements are different from those in preparing a bromide print. In a print the important thing is a good surface image; in a negative the image needs to be obtained well in the substance of the emulsion in order to yield a negative of good quality and printing intensity. This is got by full exposure and slow development—that is, with a diluted or well-restrained solution. The thing to avoid is quick development—the one-minute or two-minute development which nowadays is the practice in bromide printing. Used in this way, almost any developer is suitable, but it is best to choose one which gives fair contrast, such as amidol, metol-hydroquinone, or even pyro-soda. A little tinting from pyro stain, which would be inadmissible in a bromide print, is of no account.

Grain and opacity are the two chief defects of paper negatives, and are avoided best in the special "negative paper" manufactured by a few makers. Its feature is the thin, fine-grained, tough paper on which the emulsion is coated. Among bromide papers thin, glossy papers are usually the best substitute, but the glossy surface does not lend itself well to working up with pencil or chalk. For this the class of papers sold as "Platino-matt" (a very fine matt) is best, but the varieties of bromide paper, as regards surface and thickness, are now so great that it is not difficult to choose according to requirements.

The opacity of the paper negatives renders printing much slower, and therefore waxing and oiling are resorted to (as in the early days of photography) in order to render the paper more transparent. Waxing is a rather troublesome operation, for it is necessary first to float the negative, film up, in paraffin or white beeswax, kept fluid by standing the dish containing it in another of boiling water. An alternative is to apply a mixture of castor oil, 1 oz.; alcohol, 4 ozs., to the paper side of the negative, to give it a few hours to soak in, and re-apply, if necessary. A similar mixture consists of equal parts of terebene and salad oil. I give these prescriptions here, although my own experience is that the mess and trouble really counterbalance the advantage (not enormous) in greater speed of printing.

The Enlarged-Transparency Method.

Turning now to the methods of Class II. in the scheme given above, what has been said as to the making of the same-size contact transparency applies equally when making this transparency on the enlarged scale required. This method possesses the advantage of permitting of improvements being carried out by working up or rubbing down to an extent and with a certainty which is altogether impossible on the small transparency and difficult on the enlarged negative. We have many times dwelt in the "British Journal" on the positive advantages of this system, and that there is much in its favour is evident from the avowal by so well known a worker as Mr. W. R. Bland that one article in the year 1895, commending this form of the enlarging process, had in itself amply repaid him for his twenty years' subscription to the "Journal." The working-up of transparencies is a subject by itself, for which I must refer the reader to a manual such as "Johnson's Retouching," as re-written by Bruce and Braithwaite. But let it be made clear here that in the case of the positive transparency one *sees* the effect produced by every touch of the retouching pencil, chalk, or abrading medium—not merely judges it or guesses it, as when working on a negative.

Clouds in Enlarged Negatives.

When enlarging from a small transparency according to Method 1, a sky can be printed into the large plate or paper by either of the methods 1 and 2 described under "Clouds in Enlargements" in a previous page. But, as there stated, the better plan is to make a composite positive transparency of landscape and sky which is enlarged at one operation. This can be done when following the method (1) of the small transparency, but it is much more readily and certainly carried out when making an enlarged transparency according to Method II.

The transparency of the landscape is first made, and selection then made of the clouds to go with it. A transparency is then made from the cloud negative. It will have the clouds running down below the sky-line, but by holding the two negatives back to back, the unwanted part of the sky image can be reduced away—best with a strong iodine-cyanide reducer on cotton wool—and the

two transparencies then bound film to film This is a rather delicate operation in small transparencies to be enlarged, but quite easy with enlarged transparencies.

Instead of employing a reducer, a mask may be used when making the cloud transparency by contact or enlargement. This mask is formed by blocking out the landscape transparency up to the sky line or by cutting out the outline in a print or enlargement and using this as a shield for the lower part of the cloud plate when exposing in the printing frame or enlarging lantern.

When making composite landscape-cloud transparencies by these methods it must be borne in mind that the cloud negative becomes reversed as regards right and left, which fact requires to be allowed for by inserting the negative the other way about in the enlarger, or by selecting a cloud negative with opposite lighting.

Enlarged Negative Via Untoned Print.

There is one method of producing an enlarged negative which is deserving of special mention on account of its ease and rapidity and its excellent results. It does not admit of any handwork, except that on the enlarged negative, and it calls for a camera large enough to take the plate for the enlarged negative. Nevertheless it is a method specially to be commended to the user of vest-pocket and similar small cameras who require an easy means of making enlarged negatives of, say, half-plate size for printing in platinum or carbon.

The method consists in printing from the small negative on glossy P.O.P. only to the depth at which the picture "looks right," that is not over-printing as when finishing off by toning and fixing. This print having been taken, is put aside in the dark, and the camera got ready for making the enlarged negative. A small piece of printed matter, the same size as the print, is pinned up and sharply focussed to the degree of enlargement required. If the small camera is fitted with a good lens, such as a 3-in. anastigmat of $f/6$ aperture, no better objective can be used for making the enlargement. For a half-plate the camera extension when working from a 60 by 45 mm. print will be about 10 inches. If such a lens is not available a decent 4½-inch R.R. working at $f/8$ will serve well, bearing in mind the rule that the camera extension will be as many focal lengths as the degree of (linear) enlargement plus one further focal length.

All being thus in readiness the print is pinned up, a look taken at the focussing screen to check sharpness and the placing of the picture and the plate inserted and exposed. Using diffused daylight as in an ordinary room, the print will not suffer during the period of exposure, which lasts a minute or two only at the outside. The copying can be done equally well at night, using a couple of incandescent gas burners or electric lamps. Use a slow ("landscape") plate.

Where one has a fairly powerful artificial light at disposal, such as a really good incandescent gas mantle, or, better, a fairly high-power half-watt lamp, the whole of this process can be done at night, for the printing-out paper requires a much shorter exposure

than if it were to be toned and fixed, whilst the small size of the negative allows of the printing frame being placed close to the light without risking unequal printing. Although the process is such an easy one to carry out, the results in the enlarged negatives are really very satisfactory in consequence of the beautifully fine rendering of detail in the P.O.P. print.

Some workers, chiefly those with more than ordinary skill in the working-up of prints, make use of this latter in the making of an enlarged negative by first making an ordinary bromide enlargement. On this they carry out any required work with pencil, crayon, or water-colour, then making a negative of the same size by copying in the camera. Where one has a large copying camera at disposal this, of course, is a very ready method, though it must be said that usually it is adopted by those whose work leads away to a very considerable extent from the field of pure photography, and, therefore, in this article I am less concerned with it.

Other Methods.

Of late years attempts have been made to obviate the making of an intermediate transparency and to obtain the enlarged negative directly by converting the positive image on the plate or paper into a negative one by reversal, as used with the Autochrome plate, or other means. Successful as these processes may be in skilled hands, they are not working methods which can be advocated for regular practice And so I leave them.

PHOTOGRAPHY WITH THE MICROSCOPE.

BY DR. DUNCAN J. REID, M B

Judging by the number of articles on photo-micrography which have recently appeared in the photographic journals, by the number of papers on that subject which have been read before the Royal Photographic Society, and lastly, by the fact that the Editor of the ALMANAC has thought fit to call for this article, it would look as if the general body of photographers were becoming more interested in this special branch of photography.

But what is interesting and important is that, of late, men of science have been making more general use of photo-micrography in the illustration of articles and of books on scientific subjects. It is true that, especially at high magnifications, the microscope shows things in one plane only, or, as it is called, "in optical section," and that, where different planes of the object require to be shown together, a drawing might be preferred. Drawings, however, can never be so scientifically correct nor so convincing as a well-executed photo-micrograph, and this, I think, is coming to be realised. Men, however, who are capable of doing this sort of work are not at all numerous, and it would therefore seem as if there was a very good field for those who care to devote themselves to it.

Of subjects suitable for photography with the microscope the number is infinite Some comparatively large objects, such as butterflies and other insects, flowers, large sections of plants and animals, postage stamps, and portions of bacterial cultures on nutrient media, etc., which require only a low magnification, can be done without a microscope stand at all, and with only a short-focus photographic lens and long extension camera. When we come, however, to smaller things, such as microscopic marine and fresh-water organisms, portions of insects and plants, the minute structure of plant and animal tissues, blood films, the different forms of bacteria, articles of food, sections of mineral substances, and the surface of metals, all of which require a moderate or high magnification, then we require a suitable microscope-stand and lenses, besides perfect illumination, to obtain satisfactory results.

It is necessary to mention that objects which it is proposed to photograph with the microscope have, as a rule, to be suitably prepared for the purpose. For instance, blood has to be spread out in a thin film on a glass slide, and then quickly dried, in some cases treated with a fixing solution and occasionally stained with aniline dyes; small microscopic shells and the skeletons of marine and freshwater organisms are in some cases simply strewn on a glass slide and covered with a thin cover-glass[1]; sections of plants and of animal tissues may be photographed in their fresh state in a little fresh water or salt solution, but usually they have to pass through many stages, ending in staining and mounting in various media, all of which have the effect of bringing into view structures which are otherwise quite invisible.

The beginner will, at first, probably prefer to practise on objects already prepared and mounted, but after a time he ought to learn to prepare his own slides. On this subject I beg to refer the reader to two books, one for the pure beginner, "Common Objects for the Microscope," by Rev. J. G. Wood (Routledge). and for the more advanced worker, "Modern Microscopy," by Cross and Cole (Baillière). This latter work also gives a good deal of information on the microscope as an instrument and on accessory apparatus

On the practical side of the subject I shall try to make this article as complete as possible, but naturally a great deal must be left untouched; and for those who may wish for more information on the subject, I beg to refer them to "Photo-micrography," by Mr. Barnard, and to the recently published work on the same subject by Hind and Randles (Routledge).

I propose to treat the subject under the following heads.—

1.—LOW-POWER PHOTO-MICROGRAPHY. WITHOUT THE USE OF MICROSCOPE STAND.

Apparatus required.
Illumination by:
    Transmitted light.
    Direct or reflected light.

2.—PHOTO-MICROGRAPHY WITH THE MICROSCOPE.

Apparatus.
Technique:
    Preliminary precautions.
    Management of the light:
    Transmitted light. (Axial illumination.)
    Direct or reflected light.
    Dark-ground illumination.
    Estimation of the exposure.
    Focussing.
Plates.
Making the exposure.
Development.
Printing processes.

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[1] It seems convenient to point out here that all microscopic lenses, except possibly those of very low power and immersion lenses, require the object to be covered with a cover-glass for the lens to work satisfactorily.

1.—LOW-POWER PHOTO-MICROGRAPHY, WITHOUT THE USE OF MICROSCOPE-STAND.

APPARATUS.

There is a certain class of objects, to which I have already referred, which, owing to their size and, occasionally, owing to their thickness, can be better photographed with an ordinary short-focus photographic lens than with a microscope objective. This latter has great curvature of field, and its penetrating power is not great, so that for such objects the photographic lens, with its flatness of field and its considerable depth of focus, gives much better results.

Several makers manufacture lenses specially intended for this class of work, under the names of "Micro-planars," "Micro-summars," etc.; but if one already possesses a good short-focus photographic lens of 5-inch focus or less—if an anastigmat so much the better—one can easily do this sort of work. With a 5-inch lens and a camera extension of 30 ins. one obtains a magnification of five diameters; and with a 3-inch lens and the same camera extension a magnification of nine diameters. It will be seen that it is necessary to have a camera of long extension.

ILLUMINATION IN LOW-POWER PHOTO-MICROGRAPHY WITHOUT THE MICROSCOPE.

As a source of light for this class of work we do not require anything very powerful, and an incandescent gas burner—preferably of the inverted type—or even a kerosene lamp, would be quite sufficient at any rate for transmitted light: for reflected light acetylene or the Nernst lamp would be better.

We make use of either transmitted light, when the rays are projected so as to pass through the object, or of direct or reflected light, when they are directed on to the upper surface of the object, this latter method being employed chiefly in the photography of solid and opaque objects. For this latter class of objects daylight, or, if it is available, sunlight, gives excellent results, but with both of these an upright camera would be more convenient than the horizontal model.

I shall now describe methods of obtaining these two forms of illumination:—

TRANSMITTED LIGHT (Figs. 1 and 2a).

1. Having extended the camera sufficiently to give the magnification required with the lens in use, we place the lamp at, say, 15 to 18 ins. from the front of the objective, and centre it as nearly as possible.

2. Centre the lamp more exactly by examining the position of the illuminated area on the ground-glass screen, raising or lowering it and moving it from side to side until the patch of light is, as nearly as possible, in the centre of the screen.

3. Place the object to be photographed, supported on a suitable

holder, in front of the objective, and move it to and fro until it is, roughly, in focus on the ground-glass.[2]

4. Place a condensing lens, of 4 or 5-inch focal length, and rather larger than the object to be photographed (the condensing lens from an enlarging apparatus, or a large plano-convex lens, with the plane surface turned towards the object, would do), just immediately

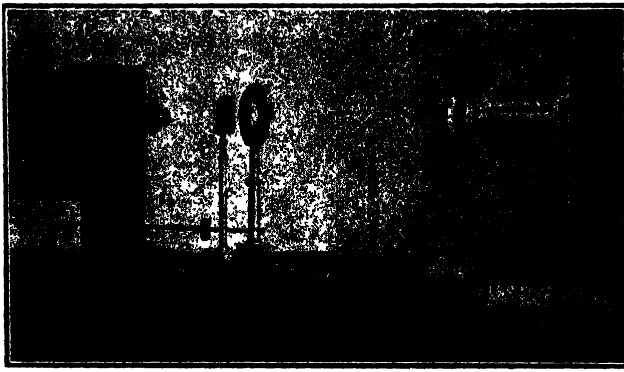

Fig. 1 —Arrangement of apparatus for illumination for photo-micrography with short-focus photographic lens using transmitted light. The system is shown in fig. 2a.

behind the object holder, and centre it by observing the illuminated area on the ground-glass, or else by the position of the image of the lamp flame it throws on the front of the objective.

5. Then if the distance of the lamp is so adjusted as just to cover the front of the objective with light, or to produce an image

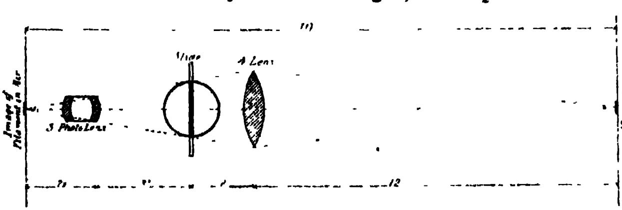

Fig. 2a —Diagram of illumination for short focus photographic lenses with transmitted light.

of the source of light, in air, a short distance within the camera, you will find that the ground-glass is uniformly and fully illumin-

[2] This is much simplified by the use of a reflecting mirror, held at a suitable angle so as to show the picture on the ground-glass whilst one is engaged in adjusting the position of the object-holder.

ated. If this is not so, the position of the lamp must be slightly altered until the illumination is perfect.

6. A final focussing can then be obtained with the aid of a focussing glass, and by slightly moving the end of the camera.[3]

DIRECT OR REFLECTED LIGHT (Figs. 3 and 2b).

1. Having extended the camera so as to obtain the desired magnification with the lens in use, we push the lamp away to the back of the table and on a line 18 or 20 ins. behind the objective, so that it is in such a position as to project a beam of light along the side of the camera. Having then adjusted the lamp to the same height

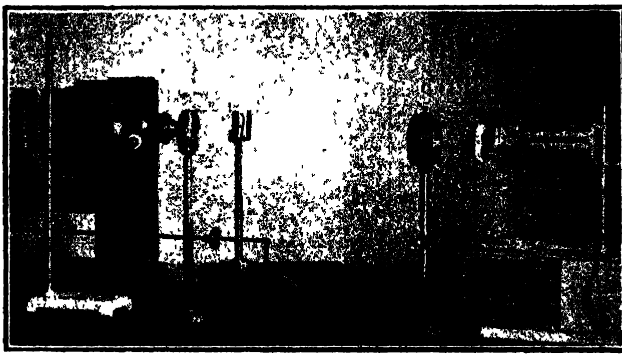

FIG. 3.—Arrangement of apparatus for illumination for photo-micrography with short-focus photographic lens, using direct and reflected light. The system is shown in plan in fig. 2b. The apparatus is here shown as moved to the front instead of to the back, as described in the text.

as the objective, we place a short-focus collecting lens (say, of $1\frac{1}{2}$ to 2-inch focal length) in front of the lamp, and, having so arranged it that it throws a beam of light along the side of the camera, we adjust it so that it gives a very much enlarged image of the lamp flame or filament on the opposite wall.

2. We then place a biconvex or crossed convex lens of, say, 9-inch focal length in the path of the beam of light. If we hold a white card in the path of the rays after they have passed through this lens, and move it slowly along, a point will be reached where they form a brightly illuminated circle of light—an image, in fact, of the collecting lens.

[3] There are object-holders to be had, provided with a focussing arrangement which permits focussing to be carried on whilst one sits at the further end of the camera. They are rather expensive, and are not really necessary unless it is advisable that the magnification should be absolutely correct. It is also easier with them to obtain the exact focus.

The nearer the two lenses are to one another the larger will the circle be, and vice versa. By this means we are able to regulate the size of the circle to what is sufficient to cover the object to be photographed.

3. The beam of light can then be reflected back on to the surface of the object by means of a plane mirror (such as a microscope sub-stage mirror) supported on some sort of stand and inclined at a suitable angle, when it becomes an oval instead of a circle.[4]

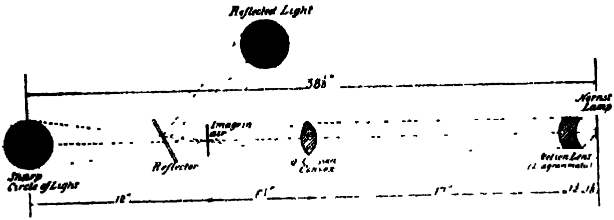

Fig. 25.—Diagram of illumination for short focus photographic lenses with direct and reflected light.

The method of supporting the object is of some importance in this form of illumination. Where we have to do with a flat, opaque object, the same form of holder as had been used for transmitted light would suffice. For small solid objects and for insects a pill-box with the bottom lined with black velvet, and the rest of its interior lined with white paper to act as a reflector, gives good results, the object being supported on the point of a needle stuck through the bottom or side of the box. For some objects the bottom of the box may also be white, when we have an effect almost like transmitted light for an opaque object.

For some objects an upright camera is more convenient, and the object is then best supported on a clean plate of glass supported on short legs, a few inches above some sort of dark material to form a background, as is sometimes recommended in the photography of flowers. Illumination can then be obtained either by artificial light, as described, or by daylight or sunlight. In either case it is advisable to have some form of reflector, or even a second lamp, so as to obtain uniform lighting of the object.

PHOTO-MICROGRAPHY WITH A MICROSCOPE STAND.

APPARATUS.

Taking it for granted that the beginner has already obtained, from the books I have recommended, some knowledge of the different pieces of apparatus required, I shall confine myself to making a few remarks under the following heads, so as to enable him to decide what apparatus he really requires :—

4 In the case of very small objects, when only a very small circle of light is required, the secondary lens might be of a shorter focus (say, of 4-inch focus), and in that case this lens would have to be placed between the mirror and the object instead of as above described.

The microscope stand.
Lenses :—
(*a*) Objectives.
(*b*) Oculars.
Camera and optical bench.
Illuminating apparatus.

Microscopic Stand (Fig. 4)

A stand with a short tube of 160 mm. or 6½ ins., is best for photographic purposes. The tube should, preferably, be of large diameter, 1½ to 2 ins., and it is well to line its interior with black velvet.

It should be particularly noted that the fine adjustment gives rise to no wobbling or side movement during focussing, indicated by movement of the objects on the "field." (The term employed

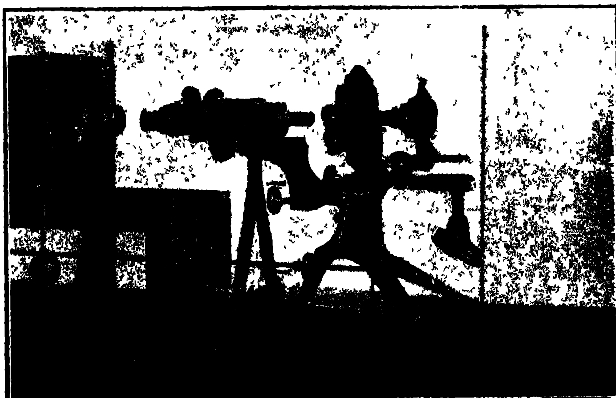

Fig. 4.—Microscope in position on bench for photo-micrography.

for the illuminated area seen on looking through the microscope). If the fine adjustment is of the lever variety, the movement with which is, in one direction, obtained by the action of an opposing spring, it is well to see that this spring is strong enough to act at once when the microscope is in the horizontal position. otherwise there is a risk of the focus changing during the taking of the photograph.

Comparing the English with the Continental model, I prefer the former for photographic purposes. With its more stable base or foot, usually consisting of three widely spreading legs, it is less likely to topple over when in the horizontal position than the Continental model with its horse-shoe foot; and then, in the English stand there is usually much more space between the stage

and the sub-stage mirror, thus allowing of more room for low-power condensers of long focus.

The sub-stage should be provided with both focussing and centering adjustments.

For high-power work a mechanical stage is almost absolutely necessary, although the beginner may do without it at first. For work with immersion condensers the built-up type of mechanical stage is best, and it should have a cross movement of at least 1½ in., and preferably 2 ins.

A few of the characteristics which a microscope stand, to be used for photography, should possess, are :—

1. It should be absolutely steady in the horizontal position.

2. The sliding parts should fit so exactly that, whilst allowing of free sliding movement there is no wobbling or side movement.

3. The whole stand should be so rigid as not to show any movement of the field during focussing, nor during the focussing or centering of the sub-stage condenser. Strange to say, the smaller models are often better in this respect.

Suitable microscopes may be obtained from almost any of the well-known makers, but as types of what I believe the beginner would find suitable, and which also fulfil most of the conditions I have referred to, I would include the following models —

Watson's Edinburgh Student's Model "F," but with focussing and centering sub-stage added. There is no mechanical stage, but it can be added when required. Price, without lenses, is about £8

Baker's D.P.H. No. 1 Model. If the mechanical stage, with which it is usually provided, is removed, it costs, without lenses, £8 8s.

For those who desire a larger model, and to whom price is not a consideration, a stand of the type of Watson's Van Heurck or of Baker's R M.S , is all that could be desired.

Lenses.

OBJECTIVES.

These form the most important part of the microscope and should be of the best quality. It is by means of the objective that the initial or primary magnification is obtained, and this is then increased so many times by means of the ocular or eye-piece, and by extension of the camera.

Objectives are divided into :—

Achromats,
Semi-apochromats, and
Apochromats.

The difference between these three classes consists chiefly in the degree of perfection it has been possible to attain, owing to the employment of special glass, in the correction of spherical and chromatic aberration In the case of the apochromats, this has reached almost absolute perfection. They are, however, expensive, and although the best for photographic purposes, the beginner may quite well confine his attention to the other two classes.

With the achromats excellent work can be done, provided that only low-power work is attempted. With the semi-apochromats, which contain fluorite in their construction, excellent high-power work can be done, provided that monochromatic light is employed, or isochromatic plates and a yellow screen.

Almost all the high-power so-called achromats are, now-a-days, semi-apochromats.

When we speak of the "aperture" of a microscope objective, we employ the term "numerical aperture," represented by N.A. It is obtained by dividing half the diameter of the beam of light capable of passing through the back combination of the lens, by its equivalent focal length, both in millimetres.

When the full numerical aperture is not employed, it having been cut down in one way or another, we employ the term "working aperature," or W.A.

The largest possible numerical aperture of a dry lens is 1.O.N.A., and lenses which possess a larger aperture than this must be immersed in a drop of fluid, such as water or cedar-oil, and the object on the slide must be mounted either in Canada balsam or in the same fluid as has been employed in the immersion of the lens. These lenses are called immersion lenses.

As the subject of aperture is an important one, and as I can only touch on it here, I beg to refer the reader to Dr. Spitta's work on the microscope, where it is fully explained; or, he may find a condensed explanation of it in my paper on "Estimation of Exposure in Photo-micrography," read before the Royal Photographic Society, in December, 1908.

It is not necessary for the beginner to have a large collection of objectives. If he has a 2-in., 1-in., and 1-4th or 1-6th in. (the latter a fluorite lens, and preferably supplied with a "Correction Collar" for making the necessary adjustments for thickness of cover-glass), he will have all that is necessary for a beginning. These three objectives he ought to be able to obtain for £3 or £4. When he has mastered these he can, later on, add an immersion objective to his equipment.

As some guide to the selection of an objective for different kinds of work, it may be pointed out that the lower the power of a lens, i.e., the longer its focal length, the greater is its covering power; and that the larger its numerical aperture the greater its resolving power, i.e., its capability of showing minute lines or dots, which lie closely together, as separate from one another.

OCULARS OR EYE-PIECES.

With achromatic objectives, one employs what are called Hughenian oculars; but with the apochromats, a special form of ocular, called a compensating ocular, is used. This latter, in addition to increasing the magnification, has also the property of correcting certain errors which exist in the apochromats, and which it has been found inconvenient or impossible to correct in the objective itself. For this reason it is not permissible to use the apochromats by themselves, i.e., without an ocular, which, however, is occasionally done with the low-power achromats (say, up to 1 in.), the

extra magnification being then obtained by extra camera extension. When this is done it is necessary, in order to prevent reflection from the inside of the draw-tube, to introduce a short tube lined with black velvet, or, "dummy ocular," into the upper end of the draw tube.

Oculars, especially those of the compensating variety, are usually numbered according to the number of times they increase the initial magnification, and it is a pity that this is not always done in the case of the Hughenian oculars.

One form of compensating ocular, specially designed for projection work, is called a "projection ocular." Two powers of this form of ocular (Nos. 2 and 4) are manufactured. Although primarily intended for use with the apochromats, they can also be employed with the high-power semi-apochromats. They have a more restricted field than the ordinary ocular, so that they are less likely to produce reflections from the inside of the camera. They are provided with a graduated collar by means of which, at different camera extensions, the diaphragm is always in focus on the ground glass. Altering the position of this collar alters however the magnifying power of the ocular; it is therefore necessary when making up a list of camera extensions for different objectives with this ocular (as recommended later on), to record the exact position of this collar. If the required magnification cannot be obtained with a certain objective in combination with the projection ocular, then an ordinary ocular of a higher magnifying power may be employed.

It is a good thing to construct a list [5] of the different extensions of the camera required for obtaining increasing magnifications with the different objectives in one's possession, with oculars of different powers One is thus enabled quickly to obtain the required camera extension for a required magnification with a certain objective and a certain ocular

Camera and Optical Bench.

The camera should be of, at least, half-plate size, and should have an extension of at least 30 ins., and better still 40 ins An extension of 10 ins. gives pictures of the same size as is seen on looking through the microscope, and is the shortest that can be used with any satisfaction.

Watson and Son's Laboratory Photo-micrographic Camera is an excellent model. It is of half-plate size, and has an extension of 36 inches The illuminating apparatus is supported on an optical bench, and this and the microscope are mounted on a rigid wooden turn-table. It costs £12 10s. without lamp or lenses.

Messrs. Baker also manufacture suitable models, including one designed by Mr. Barnard, which has several original features.

For those who do not wish to spend so much, Watson's Students' photo-micrographic camera can be obtained for £6 10s. (see figs. 4 and 5). It is a half-plate camera and is provided with two focussing

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[5] To make up this list one employs a Stage Micrometer, divided into, say, millimetres and half-millimetres, for the low-power Objectives, and into 1-100ths of a millimetre for the higher powers, the camera being gradually extended until the required magnification is obtained, when the position of the ground-glass is noted.

screens and a double plate holder. It can be used only in the horizontal position. It is mounted on a solid wooden support on which it slides, and which is graduated in fractions of an inch; and it has an extension of 32 ins. At the end nearest the microscope there is a brass collar which fits over the eye-piece end of the microscope in order to exclude extraneous light. It has no shutter, but this can be added. There is an extension, in the form of a turn-table, on which the microscope, lamp and other illuminating

Fig. 5.—Camera of 30 in. or 40 in. extension suitable for photo-micrography.

apparatus can be mounted, but if a small source of light is employed, this extension is not long enough, and they would, therefore, have to be placed on the table on which the whole apparatus requires to be supported. Regarding this table, it should be of massive construction, and it is a good thing to have the camera and its extension firmly screwed to it. It should be supplied with a drawer in which to keep lenses and other pieces of apparatus. I should have said that along one side of the support on which the camera bellows slides there is a long rod which connects with the fine adjustment, so that focussing can be carried on whilst one sits at the far end of the camera. It is convenient to have a few metal masks, with round openings, to fit into the screen end of the camera just under the focussing screen.

ILLUMINATING APPARATUS

This includes.—

- The source of light.
- Collecting lenses.
- Water tank.
- Sub-stage condensers.
- Colour screens.

THE SOURCE OF LIGHT.

The kerosine lamp, with a flat wick, a metal chimney and a glass plate in front, is a source of light with which some excellent even high-power work has been done. The actinic quality of the light is said to be increased by the addition of a small lump of camphor to the oil. The flat of the wick gives a very uniform illumination to the field, especially with low-powers, but it is far inferior in intensity to that obtained with the edge of the flame, although with the latter it is, on the contrary, not so easy to obtain a uniformly illuminated field. For the beginner, this is a very convenient source of light.

The incandescent gas burner is used by many workers especially with low-powers.

The acetylene gas jet is about 12 times more powerful than the kerosine lamp, using the edge of the flame, and is therefore suitable even for fairly high-power work. It is better, however, to use the single burner which gives a long narrow flame, something like a candle flame, it being more difficult to obtain a uniform illumination with the flat flame if the edge is used, just as in the case of the kerosine lamp.

The Nernst filament lamp is about 20 times more powerful than the kerosine lamp, and therefore requires comparatively short exposures. It is, however, a small source of light, and therefore requires some care, to use it successfully. It is rather fragile and must not, therefore, be used roughly

The small arc lamp, is, however, the ideal illuminant for photomicrography. It is several hundred times more powerful than the kerosine lamp, depending on the ampèrage of the current, and for low-power work would therefore be unnecessarily strong, although that can be corrected by the use of screens. It works more satisfactorily with the continuous current

COLLECTING LENSES.

For reasons which will be explained later on, some sort of collecting lens is necessary, or at any rate desirable. It may be a simple plano-convex lens or bull's eye, but a lens of the type of the well-known Nelson collecting lens (which consists of two uncorrected lenses, so arranged as to diminish the amount of spherical and chromatic aberration found in the former) is better. By some makers, achromatic collecting lenses are recommended, and are certainly excellent, but they are expensive and are not actually necessary.

The collecting lens should be mounted on an adjustable stand, and should be provided with an iris diaphragm, which is useful in centering and other adjustments. I think it is preferable to have the collecting lens quite separate from the lamp.

WATER TANK.

With the electric arc lamp, and even with the Nernst lamp, it is necessary to interpose between the lamp and the microscope a flat glass tank filled with boiled water, in order to obstruct the heat rays. If this is not done, injury may be caused to the object and to valuable lenses. For the arc light there should be at least two inches of water for the rays to pass through.

SUB-STAGE CONDENSERS.

These are lenses, something like an objective, which are mounted on the sub-stage, and serve to concentrate the light on the object to be photographed.

As the sub-stage condenser ought to be of a focal length closely approximating to that of the objective in use, and ought to have an aperture at least as large and preferably a little larger, it would appear as if it were necessary to have a regular battery of condensers. This, however, is not really necessary, because if we have a high-power condenser of 1.0 N.A., it is usually possible by removing its front lens or combination, to convert it into a low-power condenser with a N.A. of about 0.40. If one has to do much work with immersion objectives of large aperture, it would also be advisable to have an oil-immersion condenser of over 1.30 N.A. Several makers construct sub-stage condensers which even fulfil all three functions—namely: When used dry, a condenser of 1.0 N.A.; when immersed in cedar-oil, a condenser of 1.30 or 1.40 N.A.; and when used dry with the front removed, a low-power condenser of about 0.40 N.A.

The English model of condenser usually consists of lenses of small size compared with those of the Continental model. With sources of light of small size, the former is to be preferred, especially if space is limited, as will be apparent when we come to the consideration of methods of illumination.

COLOUR SCREENS

In addition to the ordinary use of yellow screens with colour-sensitive plates, we also employ screens of different colours for the purpose of obtaining either detail or contrast, as the case may be. For instance, to obtain detail in a coloured object, we employ a screen of a similar shade of colour and give an increased exposure according to the "exposure factor" for that special screen or combination of screens. To obtain contrast, on the other hand, we employ a screen of a complementary colour to that which we wish to emphasise in the picture, e.g.: yellow for blue, blue for yellow, green for red, and so on.

The subject of screens and their use is, however, a very important one, and as there is only just space to refer to them here, I may refer the reader to a pamphlet issued by Messrs. Wratten and Wainwright, on Photomicrography, in which the subject of colour-screens is fully explained, and in which they also give the "exposure factors" for their "M" screens when used with the "M" plate and various illuminants. These screens are a useful set to have, consisting as they do of nine different colours or shades of colour. (A,B,C,D,E,F, G,H, and K3.)

THE TECHNIQUE OF PHOTO-MICROGRAPHY WITH A MICROSCOPE STAND.

PRELIMINARY PRECAUTIONS.

All operations should be conducted in a room where there is little risk of vibration either from passing traffic or from people moving about the house, and, if this is not available, then work must be carried on during the quieter part of the day.

Changes of temperature are also to be avoided whilst work is going on.

Naturally, if the arc light is employed, necessitating very short exposures, the risks arising from vibration and from the expansion or contraction of metal are almost abolished.

MANAGEMENT OF THE LIGHT.

TRANSMITTED LIGHT. (AXIAL ILLUMINATION.)

This is probably the most important part of the subject, and I shall therefore try to make it as clear and as complete as possible.

As a preliminary, it is, however, well to point out that there are two conditions which must be fulfilled if this form of illumination is to be satisfactory :—

1st. That the "field," as seen by looking through the microscope with the ocular to be employed (or, at any rate, as much of it as will be included in the photograph), should be uniformly and fully illuminated.

2nd. That the back of the objective (as seen by looking down the tube with the ocular removed) should be evenly and completely filled with light, to the full extent of the aperture in use.

Normal Method of Illumination for High and Medium Power Dry Objectives (of 0 95 N A down to 0 65 N A)

Let us suppose the microscope to have been placed in the horizontal position (Figs. 6 and 7), with the draw-tube

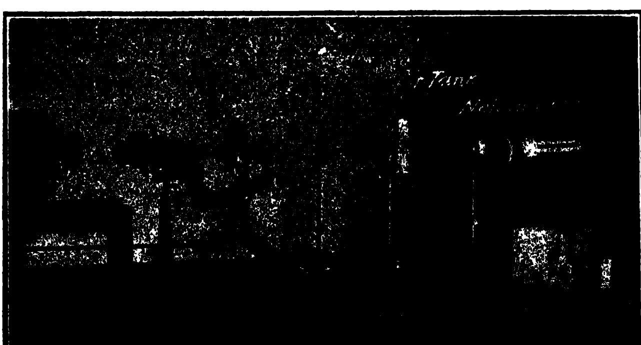


Fig. 6.—Apparatus set for normal method of illumination for high and medium power dry objectives of 0·95 N.A. to 0 65 N A., as shown in fig. 7.

extended to 160 mm., with a 1-6th objective of, say, 0.80 to 0.85 N.A., and an ocular of medium power, with a high-power dry sub-stage condenser of 1.0 N.A. on the sub-stage, and with a 1-amp.

Nernst filament lamp[6] placed at about 21 ins. from the back of the sub-stage, and as nearly as possible in a line with the tube of the miscroscope and on a level with it, we light the lamp and proceed as follows :—

1. *Focus the objective on the object.*—Looking through the ocular, bring the object into view of the field, and focus it.

2. *Centre the sub-stage condenser.*—Still looking through the ocular, shut the sub-stage iris almost as far as it will go, then bring the small opening of the iris into view on the field by rack-

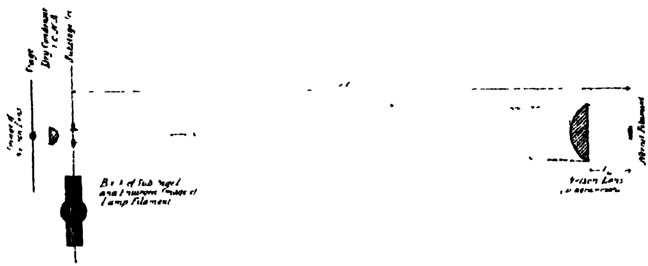


Fig. 7. Diagram of illumination system (with Nernst lamp and Nelson lens) for high and medium dry objectives, 0 95 N A to 0 65 N A.

ing the sub-stage up or down as may be required, and centre it by means of the sub-stage centering adjustments. Care must be take not to disturb this centering during the later steps.

3 *Focus and centre the source of light.*—Still looking through the ocular, carefully open up the sub-stage iris until it is well open, and rack up the sub-stage condenser by means of the sub-stage focussing adjustment until the lamp filament appears sharply on the field, and centre it by moving the lamp from side to side and by raising or lowering it, as may be required.

The centre of the field is now brightly illuminated by an image of the lamp filament, the rest of the field being only faintly lit up by means of reflected light. The shape of the illuminated area, and also its extent, naturally depends on the size and shape of the source of light.

The condition of things existing above is of no use in photo-micrography, and the following steps show how this defective arrangement may be remedied :—

4. *Introduce collecting lens in front of lamp.*—Personally, I make use of the Nelson collecting lens, of about 1½ ins. focal length. Place a collecting lens in front of the lamp, with the convex surface towards the microscope, and focus it so as to throw a sharp,

[6] I have selected the Nernst lamp because, being a very small source of light it is sometimes difficult to fulfil the conditions of perfect illumination with it, and because, if one can succeed with it, there should be no difficulty with any other larger) source of light.

enlarged image of the lamp filament on the back and exactly over the opening of the sub-stage iris (which should be open just sufficiently not to be seen on looking down the tube with the ocular removed), and adjust it roughly to the proper height by raising or lowering the collecting lens on its stand, as may be required.

It is very important that the enlarged image of the lamp filament (or whatever the source of light may be) appearing on the back of the sub-stage iris should be large enough entirely to cover the opening of the iris, and if it is not so, the lamp and collecting lens must be moved further back. (This explains why sub-stage condensers with large lenses are so troublesome.)

If this were not done, it would be found, on looking down the tube, that the back of the objective was crossed by a band of light, with a small dark area on either side, which is not correct.

It is hardly necessary to point out that the "enlarged image," which is thrown on the back of the sub-stage, increases with the size of the source of light, with the shortness of focus of the collecting lens, and with any increase in the distance of that lens from the back of the sub-stage.

5. *Centre and finally adjust the collecting lens.*—Close the iris of the collecting lens until it is quite a small opening, and, looking through the ocular, focus this small opening on the field by means of the sub-stage focussing adjustment; then centre it, if necessary, by moving the collecting lens from side to side and by raising or lowering it, as may be required.

Then, see that the collecting lens is at right angles to the lamp, and that the image of the lamp filament is still right over the opening of the sub-stage iris. The iris of the collecting lens may then be opened up, but only sufficiently to prevent its being seen at the edge of the field.

The field should now be uniformly illuminated to the very edge.

If the field is darker on one side than the other, the centering has not been properly carried out; and, if the edge of the field is fringed with red, the collecting lens may be pushed a very little nearer to the lamp. If this does not correct the fault, and if the whole field is to be shown in the photograph, then the lamp and collecting lens must be brought rather nearer to the back of the sub-stage, care being taken, however, that by doing so the "enlarged image" is not rendered too small to cover the iris opening.

6. *Eliminate fog, etc.*—If the object is sharply in focus, but still appears foggy, the sub-stage iris may be slightly closed, but only as much as is absolutely necessary to obtain the desired effect. At this stage, also, any alteration of tube length, or of correction collar, for thickness of cover-glass, should be made. As this is a matter which requires a good deal of explanation, I must refer the reader to the books on the microscope which I have already mentioned.

7. *Colour screens* may now be introduced, care being taken that they are placed exactly at right angles.

We have now to consider the

Modification of Normal Method of Illumination required for Immersion Lenses, of 1.30 *N.A.* (*Fig.* 8)

If we replace the 1-6th objective which we have been hitherto using by an immersion objective, of 1-8th or 1-12th in. focus, and of 1 30 N.A , and immerse it in cedar oil, still leaving the dry sub-stage

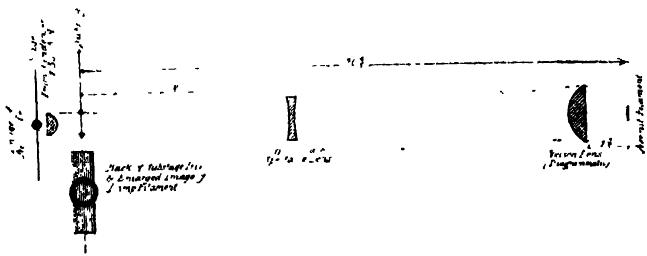


Fig 8. – Diagram of illumination system (with Nernst lamp and Nelson lens) for immersion objectives over 1 0 N.A

condenser in position, and again carry out the steps described under the "Normal Method of Illumination," we shall find that, although the "field" is perfectly illuminated, the back of the objective is only filled with light to the extent of about 3-4ths of its aperture.

This state of affairs is perfectly satisfactory for many subjects, but if (as for instance, in the photography of bacteria) we want to make use of the full aperture of the objective, then we must proceed as follows.—

1. We introduce, in place of the dry sub-stage condenser, an immersion condenser of at least 1.30 N.A., immersed in cedar oil, and then carry out the steps of the "Normal" method of illumination When we have done this it will be found that with the lamp at the former distance of 21 ins., it is not possible to obtain an image of the filament large enough to cover the opening of the sub-stage iris (which should now be nearly fully open), and that, as a result, the back of the objective as seen by looking down the tube is crossed by a broad band of light and not fully illuminated as it should be.

2. To remedy this state of affairs, we can do one of two things:—

   1. If we have plenty of room, we can remove the lamp and collecting lens further back, until the image of the lamp filament is large enough for our purpose (which will be found to be at a distance of about 34 ins. from the back of the sub-stage), and then proceed as directed by the "Normal Method."

   2. If, on the other hand, our available space is limited to the normal distance of 21 ins., having gone through the different steps of the "Normal" method, except that we have an immersion condenser,

We then proceed as follows:—

(*a*) Introduce, 7 or 8 ins. behind the sub-stage, a bi-concave spectacle lens of 4.5 dioptries (9-in. negative focus), and as nearly as possible in the correct line.

(*b*) Readjust the collecting lens so as again to give a sharp image of the lamp-filament on the back of the sub-stage iris, the full opening of which it will now be found to completely cover.

(*c*) Slightly close the collecting lens iris, and focus it sharply on the field by means of the sub-stage focussing adjustment.

(*d*) Centre the collecting lens iris on the field, this time, however, by moving the newly added spectacle lens from side to side, and by raising or lowering it as may be required.[7]

Modification of Normal Method of Illumination, for Medium Power Objectives. (1-4*th and* ½-*in., of* 0.40 *N.A., etc.*)

If we illuminate these two objectives by the Normal method, it will be found that while the full aperture of both lenses is filled with light, only the centre of the field is illuminated. This would seem to indicate either using a sub-stage condenser of a lower power, or bringing the lamp and collecting lens nearer to the microscope, possibly to a distance of 10 or 12 ins. Whilst this latter plan is sometimes adopted, especially in visual work, it is inconvenient for photography, as it allows no space for other apparatus, and besides the microscope is more apt to be affected by the heat of the lamp.

It is therefore better to illuminate these two, and other medium dry lenses, with an aperture of 0.40 N.A. or less, in another way. (Fig. 9). I shall first of all deal with the two we have selected :—

1. Arrange the lamp and collecting lens as described under the "Normal Method of Illumination."

2. Adjust the collecting lens so as to throw a sharp, very much enlarged, image of the lamp-filament on the roof, by reflecting the beam upwards by means of a piece of glass held at a suitable angle, afterwards examining the field to see that the centering of the collecting lens has not been destroyed.

3. Then, place as a supplementary collecting lens, a double convex, or crossed convex lens, of about 9-in. focal length, and of about the same size as the principal collecting lens (a small reading glass, mounted on a suitable stand would do) at a distance of 9 ins. behind the sub-stage iris.

4. As soon as the supplementary lens is placed in position, it will be found to produce a sharp image of the lamp-filament on the back of the sub-stage iris, about half the size of the image produced by the collecting lens alone.

All that has then to be done is to :—

(*a*) Slightly close the collecting lens iris, and focus it on the field by means of the sub-stage focussing adjustment.

[7] Sometimes when using an immersion condenser (especially with very thin slides) it is found that the cedar-oil has a tendency to run down, so that the condenser is only partially immersed. This can be prevented by introducing a cover-glass between the front of the condenser and the under surface of the glass slide, and connected to both by drops of cedar-oil.

PHOTOGRAPHY WITH THE MICROSCOPE.

BY DR. DUNCAN J. REID

Fig. 1. Point of fine (No. 8) needle × 80. Reflected light. 1 inch achromat. W.A. 0.15. Density 1'. Diffusion Factor 1600. Exposure 10 minutes.

Fig. 2. Fine sewing cotton × 30. Reflected light. 1 inch achromat. W.A. 0.15. Density 1'. Diffusion Factor 900. Exposure 90 seconds.

Fig. 3.—Spider's Web at junction of thread. × 400. Dark ground illumination. 8 mm. apochromat. N.A. 0.50. Density 2. Exposure 60 seconds.

Fig. 4.—Section of cedar pencil. × 200. Transmitted light. 8 mm. apochromat. N.A. 0.40. K3 screen. Density 1. Exposure 1 second.

Fig. 5.—Even density of a photographic negative. ×500. Transmitted light. [illegible] mm. apochromat. W.A. 1.0. Density 1.2. Exposure 90 seconds.

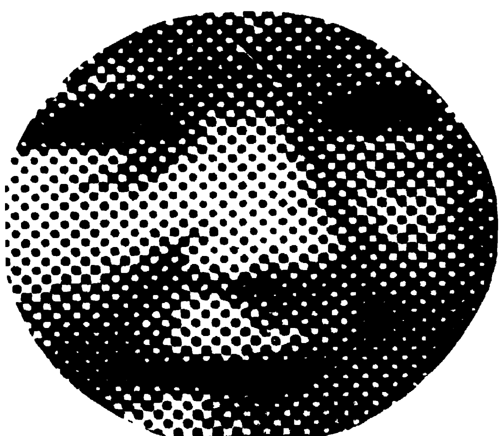


Fig. 6.—Child's face from half-tone print. ×15. Reflected light. 2 in. achromat. W.A. 0.07. Imperial process plate. Diffusion Factor = 1600. Exposure 100 seconds.

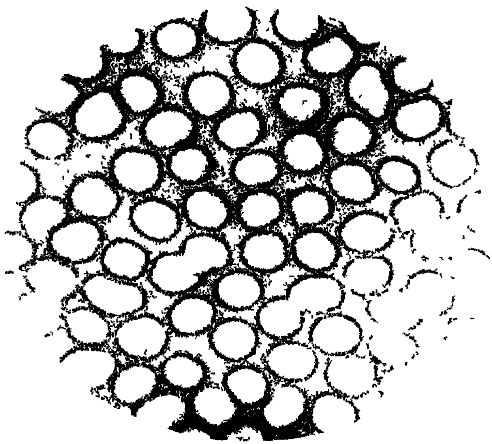
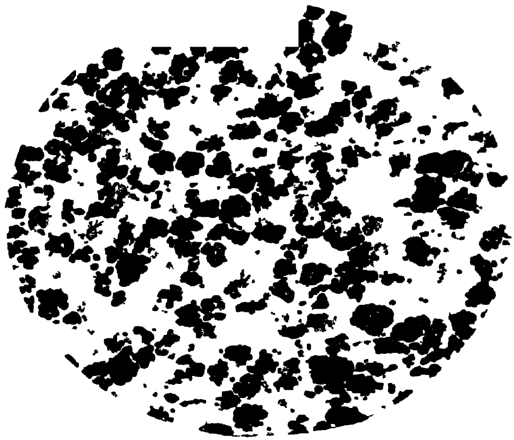


Fig. 7.—Human red blood cells. ×750. Transmitted light. 5 mm. apochromat. N.A. 0.60. K2 screen. Exposure 6 seconds.

Fig. 8.—Section of coal. ×10. Transmitted light. 80 mm. Micro-Summar. N.A. 0.15. Green. Density 2. Diffusion Factor 16,00. Exposure 100 seconds.



[illegible] granules (stained iodine) [illegible] 5. Reflected light. 1 in. achromat. W.A. 0.17. K5 screen. Density [illegible]. Diffusion Factor [illegible] 50. Exposure 2 [illegible]

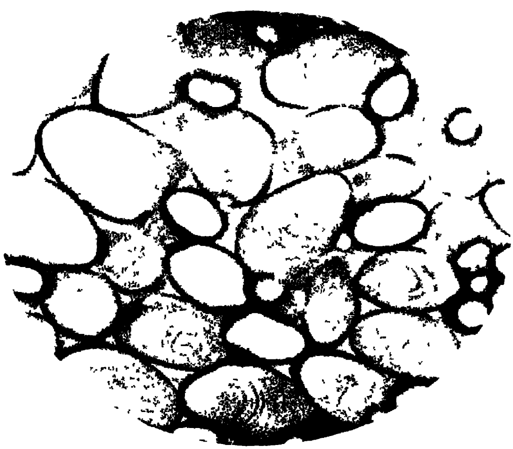


Fig. 10.—Potato starch granules × [illegible]. Transmitted light. 8 mm. apochromat. W.A. 0.[illegible]. K3 screen. Density 1. Exposure 2 seconds.

Fig. 11 Hind feet of flea. × 80. Transmitted light. 1 in achromat W.A. 0 16. B screen. Density 2. Exposure 5 seconds.

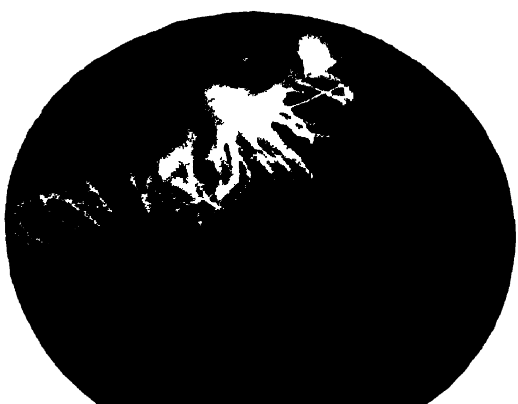


Fig 12. Hairs in throat of viola. × 2[illegible]. Reflected light. 2 in. achromat. W.A. 0 08. Diffusion Factor × 450. Exposure 60 seconds.

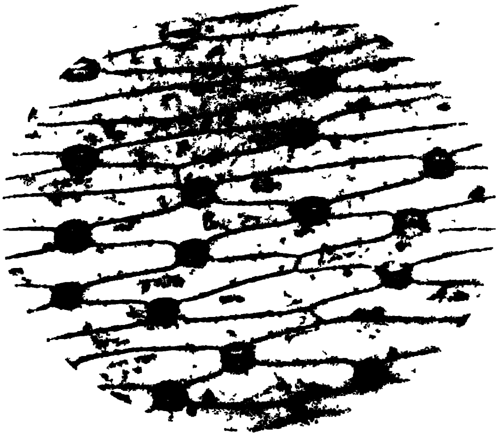


Fig. 13 Epidermis of Iris. × 100 Transmitted light. 16 mm apochromat W A 0·23 Density 2 Imperial process plate Exposure 4 seconds

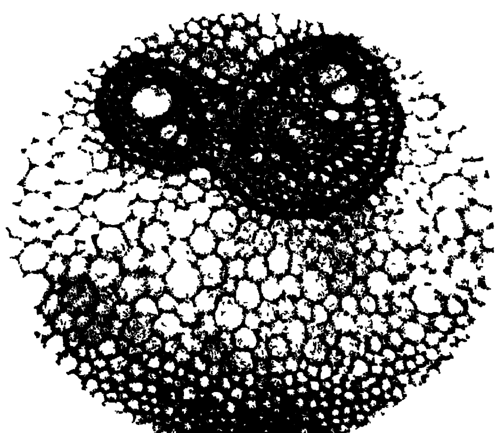


Fig. 14 —Transverse section of Stem of Fern. × 75. Transmitted light. 16 mm apochromat. W.A 0·16, K3 screen. Exposure 1 second.

Fig 15.—Reproductive organs of Hollyhock. × 5
Reflected light, 5¾ inch anastigmat. W.A. 0·07
Diffusion Factor × 1600 Exposure 25 seconds

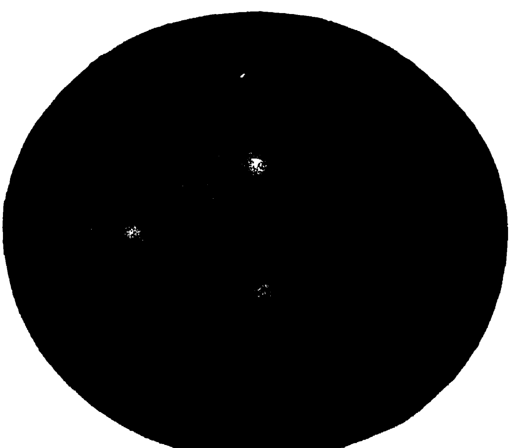


Fig. 16.—Pollen of Hollyhock. × 65. Reflected light.
1 in. achromat. W.A. 0·17. Diffusion Factor × 225
Exposure 90 seconds

(*b*) Centre it, by moving the "supplementary lens" from side to side, and by raising or lowering it as may be necessary.

It will now be found, if the iris of the collecting lens is opened up, that the field, in the case of both objectives, is uniformly and fully illuminated, and that the back of both objectives is also filled with light.

Modification of Normal Method of Illumination required for Low-power Objectives (1-in. and 2-in.)

Strange as it may appear, it is more difficult to fulfil the conditions of perfect illumination with low-power objectives than it is with medium or high powers. It is therefore often recommended,

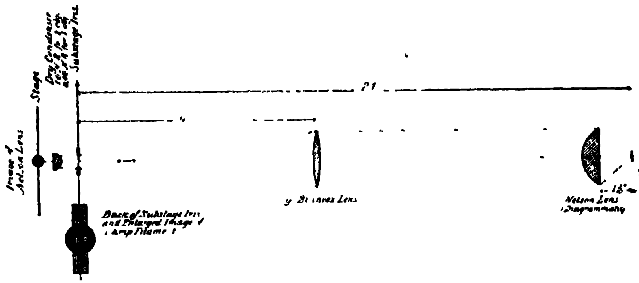


Fig 9.—Diagram of illumination system (for Nernst lamp and Nelson lens) with medium and low power objectives, 0·40 N.A. and under.

when using low powers, to employ ground-glass in the sub-stage or elsewhere, but this absorbs a great deal of the available light, and is not really necessary.

In the case of the 1-in. objective (with which might also be included the ⅔-in.) the system of illumination is exactly what has been recommended for the medium-power objectives, except that the dry sub-stage condenser of 1·0 N.A. must have its front combination removed, thus converting it into a low-power condenser of about 0·40 N.A. (Fig. 9).

It is necessary, however, to point out, in connection with the use of these half-condensers, that it is often impossible to centre them after the plan recommended in step 2 of the "Normal Method," for the reason that the iris cannot be brought into view on the field, as can be done with the complete condenser. It is therefore better to carry out the centering with the complete condenser, and then, without removing it from its sub-stage mount, carefully to remove its front combination.

The illumination of the 2-in. objective is not quite so simple as that of the 1-in. If we proceed as has been suggested for the 1-in., it will be found that only half the field is illuminated, although the back of the objective is filled with light. This indicates either bringing the lamp and collecting lens nearer or else employing a sub-stage condenser of a still lower power. We have

decided that it is inconvenient to do the former, and the latter may not be available. It is therefore better to do away with the sub-stage condenser altogether.

We then proceed as follows:—

1. Arrange the illumination as if for the 1-in. objective, and, in fact, it is rather easier if this step is carried out with the 1-in. objective in the first place
2. Having then removed the sub-stage condenser and replaced the 1-in. by the 2-in. objective, we bring the 9-in. supplementary lens close up to the back of the sub-stage until a sharp image of the lamp filament appears on a slip of paper resting against the front of the objective. This image should exactly cover the lens. If there is now the slightest tinge of red on examining the field the principal collecting lens ought to be pushed a trace nearer the lamp.

Illumination with the Microscope in the Vertical Position.

If the microscope is to be employed in the vertical position, which is often compulsory for some objects, the same methods of illumination may be adopted, except that the sub-stage mirror has to be used.

In concluding what I have had to say about illumination with transmitted light, I wish to point out that too much importance must not be given to the distances for the positions of the different lenses which have been given. Those are as a matter of fact, correct for the sources of light and the lenses employed, but they would, of course, be subject to alteration for larger sources of light, for a collecting lens of a longer focal length, and for sub-stage condensers of a different type.

What has been attempted is to explain the principles of illumination. If the beginner simply reads over the description given of the different methods, he will find it very dull reading indeed but if, whilst reading, he tries to put the different steps described into execution, he ought, in course of time, to find no difficulty in obtaining correct illumination with any objective and with any source of light.

Direct or Reflected Light

This method of illumination has already been fully explained under the heading of "Photography Without Microscope Stand" at the beginning of this article, and is essentially the same when the stand and microscope objectives are used (Fig. 2b). With these latter, however, only a very small circle of light is required. It would therefore be necessary to use a "supplementary lens" of a shorter focal length than the 9-in lens, say one of 4-in. focus. This 4-in. supplementary lens would then have to be placed between the reflecting mirror and the object.

The method of obtaining reflected light here described will be found practicable for objectives up to, possibly, ⅔ in., but for lenses of a higher power than that other methods would have to be adopted, for which I must refer the reader to works on the microscope.

Dark-ground Illumination.

This method of illumination, which shows the objects brilliantly illuminated on a dark-ground, gives very beautiful results, and, since the introduction of the immersion dark-ground illuminator, has, of recent years, attracted much attention.

Owing to want of space, I must confine my remarks to dark-ground illumination with the aid of the ordinary sub-stage condenser (dry or immersion) and even then they must be very incomplete.

For those who wish to have more information on the subject, I beg to recommend a paper on "Dark-ground Illumination in Microscopical Work" by Maurice Ainslie, B.A., R.N., published in the "Journal of the Royal Army Medical Corps," for April, 1913; or to Dr. Spitta's work on "Microscopy," in both of which it is treated at considerable length.

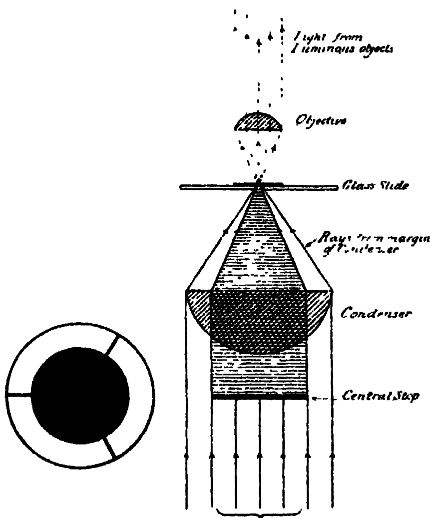


Fig 10.—Rough diagram of dark ground illumination with substage condenser and central stop.

By means of the ordinary sub-stage condenser, with a central wheel-stop introduced into the carrier of the sub-stage, one can obtain perfect dark-ground illumination with all dry objectives, up to the 4 mm. of 0.95 N.A.

One of the important points is that the stop should be of exactly the right size. This result is best attained by introducing stops of gradually increasing size, one after the other, until a good black background is obtained.

The selection of stops usually provided by the makers is too limited and the gradations in size too abrupt; but those can be easily added to, but cutting out round discs of black paper and sticking them either to the existing stops or to round cover-glasses.

By means of the stops all the rays which usually enter the objective in the form of transmitted light are obstructed. The only light then received by the objective is what comes from the objects themselves, which have become luminous by rays received at a considerable angle, from the periphery of the condenser (Fig. 10.)

A Davis shutter (which consists of a small iris which screws on to the lower end of the tube, just above the objective) is often a help in obtaining a good dark background. It must, however, be used with great care, otherwise, if closed too far, it is apt to produce diffraction effects and to destroy the image. If the size of the central stop is carefully selected, it is, however, rarely necessary to close the Davis shutter at all.

As sources of light, acetylene and the Nernst lamp are both excellent, and incandescent gas mantles also give good results, but for high magnifications a small arc lamp is best.

As the light in dark-ground illumination comes, as I have said, from the periphery of the condenser, it is necessary that it should have a considerably larger aperture than the objective in use. The following, for instance, would be suitable condensers for the accompanying objectives —

For 4-mm. objective, of 0·95 N.A.	Immers. Cond. of 1.30 N.A.
,, ⅙-in. objective of 0·40 N.A.	Dry Cond. of 1 0 N.A.
,, ½-in. objective of 0 35 N.A.	,, ,, ,,
,, 1-in. objective of 0 20 N.A.	,, ,, 0 40 N.A.
,, 2-in. objective of 0 08 N.A.	,, ,, 0 25 N.A.

The method of illumination may be as follows :—

The lamp and collecting lens having been arranged, and everything centred, exactly as described under the "Normal Method of Illumination," except that the suitable condenser has been selected, and with the sub stage iris fully open :—

The collecting lens, also with its iris fully open, is gradually pushed nearer to the lamp, until the full opening of the sub-stage iris is rather more than covered by a rather blurred image, with red-fringed edges, of the lamp filament. If a suitable stop is then introduced into the sub-stage carrier, and the focus of the sub-stage condenser finally adjusted, a good dark-ground should be obtained. With medium and high powers, thick slides must be avoided.

With some objectives, a better result is obtained by placing the 9-in. supplementary lens a few inches behind the sub-stage iris, and, after everything has been centred as described under "Illumination with Transmitted Light for Medium Powers," the principal collecting lens is pushed nearer the lamp so as to give a blurred image of the filament on the back of the sub stage, and the stop and condenser adjustments carried out exactly as just described.

ESTIMATION OF THE EXPOSURE.

There are many who prefer to judge of the exposure required, by the appearance of the image on the ground-glass, but this plan is of no use to the beginner, and is often impossible, even to the experienced.

In December, 1908, before the Royal Photographic Society, I described a method of estimating the exposure in photo-micrography, for axial illumination, by the measurement of the Ramsden disc, from which it is easy to calculate the numerical aperture. There are one or two reasons why this method might be somewhat difficult for the beginner, and I therefore propose to suggest another method, which, although not quite so exact, is easier, and will, I hope, be found useful

One advantage of a method of this kind is, that if careful notes are kept of all exposures, and the conditions under which they are made, one can repeat a photograph under exactly similar conditions to those under which it was first taken.

EXPOSURE BY TRANSMITTED LIGHT, AND AXIAL ILLUMINATION.

The length of exposure depends on —

1 Intensity of the light and the method of using it.
2 Rapidity of the plate
3 Colour screens in use.
4 Magnification.
5 Working aperture, or W A
6 Density and colour of the object

If, therefore, we take a series of strip photographs, at regularly increasing exposures (say, 2, 3, 4, 6, 8, etc , seconds), on a certain make of plate, with a certain source of light, and with the illumination arranged as I have described, and at a certain magnification and aperture, it is easy to select the strip which gives the best result. We then have what we consider the best exposure for that combination of factors.

Acting on these lines, from a series of strip exposures on the Ilford "Chromatic" Plate, at a magnification of 500 diameters, and at a working aperture of 0·50 (the kerosine lamp being the source of light), an exposure of 50 seconds was considered to give the best result.

But the exposure has to be varied *directly* as the square of the magnification. It is therefore easy to construct a table of exposures for all other magnifications, taken under the same conditions.

The exposure also varies *inversely* as the square of the numerical aperture, so that it is also easy to frame a table of multiplying and dividing factors for all other apertures.

We have here a table of exposures for different magnifications at 0 50 N.A , and another table of multiplying and dividing factors for other apertures, constructed on these lines, for the Ilford "Chromatic" plate, and the edge of a kerosine lamp flame as the source of light.

Another table constructed on similar lines, but for low magnifications (10 to 100 diameters) at 0·10 N.A. is also given.

The kerosine lamp was used instead of a more powerful illuminant, for the construction of the tables, in order to avoid the use of fractions for the shorter exposures.

Another series of strip exposures was also made at the same magnification and aperture, for the Nernst lamp and the same plate, and the best exposure was found to be 2½ seconds. Dividing 50 by 2½ gives 20 as the dividing factor for the Nernst lamp and the Ilford plate, when the tables are used to ascertain the required exposure with that combination.

The factor for all other combinations of any plate with any source of light can be easily found in the same way.

The only thing which requires to be explained is how to ascertain the working aperture, i.e., the aperture at which the photograph is being taken.

The principle of the method I am about to describe is simply this:—

That if the opening of the iris of a certain condenser is known, when of a certain diameter, to represent a certain aperture, then all other apertures with that condenser are in direct proportion to the diameter of the iris opening, provided, however, that *critical illumination* is employed

As a matter of fact, based on this principle, Messrs Watson, Messrs. Leitz, and possibly other makers, have the mounts of some of their condensers graduated so as to give the N.A. corresponding with the opening of the iris.

The difficulty, however, is that the graduation is only correct for the condenser for which it was intended. In this connection, it must be pointed out that when the front of a high-power condenser is removed, it becomes another, low-power condenser, for which another graduation would be required

It is possible to get over this difficulty, however, in quite a simple way, as follows.—

If our condenser is a high-power one of 1·0 N.A., which we also employ as a low-power condenser by removing the front combination, we might get the makers of our objectives to confirm the exact numerical aperture of, say, a 1/6th and of a 1-in. objective.

Taking first of all the 1/6th objective, of say 0·85 N.A. and the complete condenser of 1·0 N.A. and preferably employing daylight as the source of light, we focus the objective on an object on the stage, and then adjust the condenser so as to give ritical illumination. Looking down the tube, with the ocular removed, we first close the sub-stage iris and then gradually open it up, until it is *just not* visible at the edge of the back of the objective. If we now measure the diameter of the iris opening, and find that it measures say, 10 mm., then that diameter represents 0·85 N.A., and all other apertures with that condenser, using the same or any other objective, are in direct proportion.

The low-power condenser (i.e., the complete condenser with the front removed) can be calibrated by using the 1-in. objective exactly in the same way.

(NOTES.—I find that the best way to measure the diameter of the iris is by means of a pair of fine dividers, and then with a millimetre measure. This can be done without disturbing anything.

Regarding the term "Critical Illumination," it is said to be obtained when the objective and the source of light are both simultaneously focussed on the same plane of the object, provided that all necessary corrections have been made for thickness of cover-glass, and provided also that the sub-stage iris is open sufficiently to allow the passage of a beam capable of filling at least three-fourths of the total numerical aperture of the objective. The practical result, however, when critical illumination is obtained, is that the back of the objective is filled with light.

It is necessary to remember that, in the methods of illumination which I have recommended, the collecting lens, or, rather, its illuminated aperture, is employed as the "source of light.")

EFFECT OF COLOUR SCREENS, AND DENSITY OF OBJECT.

When a colour screen is employed it is necessary to know how many times it increases the exposure—*i.e.*, to obtain its "exposure factor" This is done by taking a series of strip photographs on a given make of plate, under exactly similar conditions, without and with the colour screen in use. In the exposure tables I have given the exposure factors for the Wratten "M" colour screens with the Ilford "Chromatic" plate and the Nernst lamp, and, as I have already said, Messrs. Wratten give the exposure factors for these screens when used with their "M" plate with different sources of light.

Regarding the effect of the colour of the object on the length of exposure, the reader will find it helpful to have a thorough knowledge of the principles of isochromatic photography. Under the heading of colour screens I have said that when detail is required in an object of a colour to which the plate in use is only slightly sensitive, we have to employ a colour screen of a similar shade of colour in order to obtain detail The increased exposure required will usually be found by multiplying by the exposure factor for the screen employed

The exposures given in the exposure tables are for objects of "average density"; for objects with less or more than the average density a diminished or increased exposure would have to be given, and this increase or diminution should always be in multiples of two. I may point out that this "density factor" is the only one which has been left to the judgment and experience of the operator, but as all other factors have been estimated, it is not a great task.

To give a simple example of how to use the Exposure Tables:—

Suppose that we are about to take a photograph on an Ilford "Chromatic" plate, at a magnification of 300 diameters, and that, after the sub-stage iris has been adjusted to give the desired effect, the diameter of it is found to be 8 mm. (a diameter of 10 mm. with the condenser in use, being known to represent 0·90 N.A.), the present aperture would be 8/10ths of 0·90 N.A., or 0·72 W.A., the source of light being a Nernst lamp, we proceed as follows:—

By the tables the exposure for 300 diameters at 0·50 is found to be 18 seconds; the dividing factor for 0·72 W.A. is about ÷ 2; and the dividing factor for the Nernst lamp with the Ilford "Chromatic" plate is known to be ÷ 20.

Therefore,

$$\frac{18}{2 \times 20} = \frac{9}{20} \text{ or about } \tfrac{1}{2} \text{ second exposure.}$$

If a colour screen had been used, then the multiplying factor for it would have had to be taken into our calculation; and the same remark applies in the event of an increased "density factor" having been employed.

Before leaving the consideration of these tables, I think it better to say that it is more satisfactory for each one to estimate a light-*cum*-plate factor for himself, because everyone has different opinions as to what is the best type of negative, and then, again, the same source of light may not with everyone give exactly the same result, much depending on how the method of illumination has been carried out.

EXPOSURE BY DIRECT OR REFLECTED LIGHT.

In this case the light is spread out or diffused, in the shape of an oval, over a comparatively large surface, corresponding to the size of the object to be photographed. The intensity of light varies inversely as the square of the diameter of the circle of diffusion. For practical purposes I have found that, in order to estimate the intensity of the light in these oval areas, as compared with that of the small point of light with which the strip photographs were taken in preparing the exposure tables, it is sufficient to square the long diameter of the oval (in millimetres). This gives us a "diffusion factor," by which the required exposure, as obtained from the tables for transmitted light, must be multiplied.

In this form of illumination we cannot measure the aperture by the method recommended for transmitted light. This, however, is of no importance, because we usually employ the full aperture of the objective when using reflected light. If it has to be reduced, as sometimes has to be done by means of a Davis shutter—in the case, for instance, of thick objects—it must be roughly estimated by the extent to which the Davis iris has been closed.

Suppose, then, that we are going to take a photograph with reflected light, by means of a Nernst lamp, at a magnification of fifty diameters, and that we are using a 1-in. objective at its full aperture of 0·20 N.A., and, finally, that the long diameter of the oval of light is 30 mm., we have the following factors to enter into our calculation:—

Exposure by tables for 50 diameters at 0·10 is about 12 seconds.
Dividing factor for 0·20 N.A. is ÷ 4.
Diffusion factor, 30 × 30 is × 900.
Nernst lamp dividing factor, is ÷ 20.

Therefore $$\frac{12 \times 900}{4 \times 20} = 135'' \text{ or } 2'\,15'' \text{ exposure.}$$

(*Continued at foot of next page.*)

TABLE OF EXPOSURES.

Using the edge of a ¾-in. flame of a kerosine lamp, at 21 ins. from sub-stage; Nelson collecting lens, and with the sub-stage condenser at its critical focus.

FOR ILFORD "CHROMATIC" PLATES.

Low Magnifications, 10 to 100 diameters.

At W.A. of 0·10: Diameters	Exposures.	× and — Factors for different W.A.	
10	0·5"	0·05	× 4
15	1·1"	0·06	× 2·8
20	2·0"	0·08	× 1·6
25	3·1"	0·10	Standard
30	4·5"	0·12	— 1·4
35	6·2"	0·14	— 2
40	8·0"	0·15	— 2·3
50	12·5"	0·16	— 2·6
60	18·0"	0·18	— 3·2
70	24·5"	0·20	— 4
75	28·0"	0·22	— 5
80	32·0"	0·24	— 6
90	40·5"	0·25	— 6·3
100	50·0"	0·26	— 7
		0·28	— 8
		0·30	9

High Magnifications, 100 to 5,000 diameters.

At W.A. of 0·50: Diameters.	Exposures.	× and — Factors for different W.A.	
100	2·0"	0·10	× 25
150	4·5"	0·15	× 11
200	8·0"	0·20	× 6
250	12·5"	0·25	× 4
300	18·0"	0·30	× 3
350	24·5"	0·35	× 2
400	32·0"	0·40	× 1·5
450	40·5"	0·45	× 1·2
500	50·0"	0·50	Standard
600	1' 12"	0·55	— 1·2
700	1' 38"	0·60	— 1·4
750	1' 52"	0·65	— 1·6
800	2' 8"	0·70	— 2
900	2' 42"	0·75	— 2·2
1,000	3' 20"	0·80	— 2·5
1,500	8' 10"	0·85	— 3
2,000	13' 20"	0·90	— 3·2
3,000	32' 40"	0·95	— 3·5
4,000	53' 20"	1·00	— 4
5,000	83' 20"	1·05	— 4·4
		1·10	— 5
		1·15	— 5·3
		1·20	— 5·8
		1·25	— 6·2
		1·30	— 6·8

Light-cum-Plate Factors.

Kerosine lamp and Ilford Chromatic plate . .	1
Nernst lamp and Ilford Chromatic plate . .	—20
Nernst lamp and Wratten "M" plate ..	—15

Multiplying Factors for Wratten "M" Colour Screens, with Nernst Lamp and Ilford Chromatic Plates —

K3	× 1·5	B cum K3	× 6
G	× 2·5	B cum G	× 8
E	× 9	B cum E	× 40
C	× 8	G cum H	× 1250
H	× 8	B cum C	× 400
B	× 5	D cum H	× 80

These calculations may be thought by some a little troublesome, and for myself I have constructed a calculator, somewhat on the principle of the slide rule, which does it all with the greatest ease and accuracy.

Note.—In connection with short-focus photographic lenses, when employed with this form of illumination, the same rules hold good

as for microscope objectives, but it is better to convert the focal apertures, with which the lens mount is marked, into numerical apertures. This is easily done by dividing 1 by twice the denominator of the focal aperture. For instance, $f/6$ is converted as follows :—

$$\frac{1 \cdot 0}{6 \times 2} = \frac{1}{12} = 0 \cdot 08 \text{ N.A.}$$

Exposure for Dark-ground Illumination.

The exposure required in this form of illumination depends on the aperture of the objective, the diameter of the central stop, and the aperture of the condenser. We are not, however, dealing with transmitted light, so that the problem becomes somewhat complicated. What I have said about the estimation of exposures ought, however, to be of some use, and I therefore intend to leave its solution to the reader.

Exposure for Transmitted Light with Short-focus Photographic Lenses.

The method of illumination recommended for these lenses is not on the same plan as that described under microscope lenses, and the tables would not give the correct exposure until a new light *cum*-plate factor had been obtained.

The same remark applies to the illumination adopted in the case of the 2-in. objective.

Focussing.

Having decided what ocular and what camera-extension will give the desired magnification, we extend the camera and connect it to the microscope by means of the brass tube or collar which fits over the end of the eye-piece. We then arrange the position of the picture on the ground-glass, and roughly focus it. Placing the plate-glass screen in position, we focus more exactly by means of a focussing-glass, making use of the long focussing-rod.

This method of focussing is sufficient for low and for medium magnifications, but for very high-magnifications, and more especially when dark colour screens are used, the spectacle-lens method, recommended by Dr. Bousfield, is better.

A bi-convex lens of about 7-in. focal length is suitable. Having found the correct position for the lens by exact focussing on fine printed matter, one can cut a flat piece of wood to the proper length, so that it is always easy to replace the lens (which must be supported on a suitable stand) at the correct distance from the position the film of the plate is to occupy. Focussing is then done in air, and requires a little practice. In employing this method it is generally better to wear glasses, correcting one's eyes for distant vision, if that is necessary.

Making the Exposure.

Having waited for a little time, in order to see that the focus shows no signs of altering, we carefully introduce the dark slide, and

either close the T. and I. shutter or else place a black card in position just behind the sub-stage. We then carefully open the dark-slide and make the exposure for the required time.

After this has been done, and the dark-slide closed, it is well to see that the focus has not altered during the taking of the picture.

Plates.

It will usually be found, especially when working with artificial light, that density is more easily obtained with isochromatic plates.

Panchromatic plates are necessary when it is desired to obtain detail in objects of a non-actinic colour, or when it is necessary to use colour screens to which the isochromatic plate is not sensitive.

Slow plates, such as "process" plates, often give excellent results with diatoms and other objects which show little contrast.

All plates should be backed.

Development.

For ordinary work I prefer pyro-soda, and in order to obtain uniform results I employ Watkins' method of "time" development.

For subjects in which considerable contrast is desired the use of hydroquinone is advisable.

As a matter of fact, the development of the plate does not differ in almost any respect from what is found in ordinary photography.

Printing Processes.

In photo-micrographic work one usually aims at the obtaining of a pure white background, when possible, and for this reason the different grades of gaslight paper are great favourites.

Where detail is desired in the print I think P.O.P. still holds its own

Whatever printing method is adopted, care should be especially taken that the contact between the films of the plate and the paper is complete, otherwise loss of detail will be observable in the print. This precaution is still more necessary in the case of lantern slides.

Here, again, there does not appear to be any great difference between this and ordinary photography, except, perhaps, that for photomicrographic prints it is usually preferable to employ glossy paper, and, if one has the energy to make them still more glossy by squeegeeing on to glass or in some other way, so much the better for the result.

NOTES ON THE ILLUSTRATIONS.

The sixteen subjects, photo-micrographs of which have been reproduced, were chosen solely for the reason that they were available to anyone without any special preparation. No. 14, section of fern, and No. 16, section of coal, are the only ones which were photographed from bought specimens; the others are common objects of the house and garden, and, therefore, illustrate the fresh

world of beauty and wonder to which the camera and microscope together open the door. I could wish that space had permitted of dealing at length with the chief methods which are necessary in the preparation of specimens for the microscope. These, however, are very completely dealt with in text-books to which I have already alluded, whilst many subjects come in a class by themselves and call for special methods of preparation As I said at the outset of this article, one of the great attractions of photo-micrographic work is the interest which it creates in other subjects and the valuable information which is obtained. The particulars given in reference to each will, it is hoped, further contribute to the usefulness of this article. The plate used, in almost every instance, was the Ilford "Chromatic" with a Nernst lamp

OBITUARY OF THE YEAR.

Among those whose deaths have taken place since the publication of the 1914 ALMANAC are —

Sir Joseph Swan (May 27, 1914).	F. P Moffat (March 19, 1914).
Sir Benjamin Stone (July 2, 1914).	Thomas Birtles (Dec 30, 1913).
B J. Edwards (May 24, 1914).	Chas. Sawyer (Sept 22, 1914).
George Hare (Nov 21, 1913).	K. W. Wolf-Czapek (Nov 30, 1913).

SIR JOSEPH SWAN

Born in 1828 at Sunderland, the earlier years of Joseph Wilson Swan's life were passed in pharmacy, during which time he showed aptitude and enthusiasm for experimental chemistry. At the end of his apprenticeship he obtained employment in Newcastle-on-Tyne with John Mawson, whose partner and brother-in-law he subsequently became When little more than a boy, Swan became associated with the discoveries of Daguerre and Fox Talbot, and on the invention, in 1851, of the wet collodion process he applied his chemical knowledge to the manufacture of the collodion itself, with the result that Mawson's collodion became a standard photographic material, and is indeed such at the present day among the many users of the wet collodion process, chiefly in photo-mechanical work. In the year 1860 the partnership with Mr. Mawson was entered into by Swan and the firm of Mawson and Swan was established.

But Sir Joseph Swan will perhaps be chiefly associated with photography by his invention, in the year 1864, of the process of carbon printing. Previous to this time endeavours had been made, chiefly by French experimenters, usefully to apply the discovery of Fox Talbot in 1852 that a mixture of gelatine and potassium bichromate becomes insoluble in water on exposure to light. The difficulty which faced the earlier workers was that in the exposure of a film or tissue bearing gelatine and bichromate together with a pigment, the effect of the light was to form a skin of insoluble gelatine over the whole surface. Attempts were made to obviate this difficulty, such as exposing the coating through its paper support, or by using, as Fargier did in 1860, a collodion support for the development of the exposed film of gelatine pigment and bichromate But up to the time of Swan's invention the process remained one which was impracticable for general work. He introduced and patented the method of transferring the exposed tissue and so developing it from the back. The exposed print was floated on a solution of indiarubber, and a piece of paper treated in like manner Both being allowed to dry, they were pressed together

with the exposed surface of the print in contact with one side of the rubber-coated paper. The tissue, thus mounted, could be readily developed in hot water, the original paper support becoming detached and the water obtaining free access to the under-stratum, or back, of the gelatine coating. Swan also introduced the plan of preparing the tissue without the addition of bichromate, employing this latter as a sensitising bath shortly before use. In England the process was acquired and marketed by the present Autotype Company; in France by Messrs. Braun, of Dornach. The process came as a notable addition to photographic printing methods, since it yielded prints of extremely fine quality and free from any suspicion of impermanence. Swan devoted his attention also to its application in the production of intaglio printing plates, and his patents contain descriptions of methods which have been utilised in the rotary photogravure processes which have been perfected during the past few years.

His partner suffering death in 1867 by an explosion of nitroglycerine, Swan for some years subsequently had little leisure for scientific experiment, but following the papers in the early seventies on the production of gelatine emulsion he turned his attention to the manufacture of gelatine dry-plates, and "Swan's Plates" were the first to appear upon the market—in the latter part of 1877. At this time, it must be remembered, the idea of ready-made gelatine dry-plates was not one which was commonly entertained Experimenters were seeking to produce an emulsion for use by the photographer himself, but in this, as in his patent of two years later for paper coated with gelatino-bromide emulsion, Swan showed the foresight with which he recognised the immense importance of the gelatine emulsion, then coming into use but by no means received favourably by the majority of photographers.

Of Swan's invention of the carbon-filament incandescent electric lamp it is not within our province to speak, but by this invention, upon which Edison at the same time was independently working, electrical illumination became a practicable thing, and Swan himself, in 1879, was the first to give a display in this country of the new illuminant. He originated the design of lamps having a carbon filament, devised methods for the manufacture of the filament, and, in short, equally with Edison, laid the foundations of this great industry.

Sir Benjamin Stone.

Born in Birmingham in 1838, Sir Benjamin Stone was associated with the Midland capital in many directions, as a manufacturer, politician, and municipal worker. His commercial interests were chiefly in the firms of Stone, Fawdry and Stone, glass makers, and Smith, Stone and Knight, paper manufacturers. Through the prosperity of these undertakings Sir Benjamin Stone was enabled comparatively early in life to occupy himself with historical study and foreign travel, and to devote also a good deal of his time to political and municipal affairs. Whatever may be the verdict of posterity as to his labours in these directions, it is as a photographer that he will be remembered by the present generation. He was, in

fact, the national photographer, for his connections with Parliamentary life gave him many opportunities of photographing subjects out of the scope of ordinary people. He photographed in his time practically every member of Parliament and many of the scenes and functions connected with the life of the upper and lower Houses of Parliament.

It is interesting to recall that Sir Benjamin was a collector of photographs long before he began to practice photography himself He was led to take up the use of a camera as a result of the difficulty which he experienced in purchasing photographs of the subjects he required whilst travelling in foreign countries. The outcome was that he became the apostle of photography as the recording art, preaching his gospel in and out of season, and finally giving it practical shape in the formation of the National Photographic Record Association, to which, during its existence, he was by far the largest contributor of photographs. Under his presidency and the secretaryship of Mr. George Scamell some 6,000 photographs were assembled, and are, we believe, still preserved in the British Museum. Subsequently Sir Benjamin perceived that such record work was more efficiently done under local auspices, and the national body, upon his suggestion, was dissolved some few years ago. But its dissolution did not curtail, but rather extended, the work of Sir Benjamin himself. At the time of the coronation of the late King Edward and of King George V. he was enabled to take a series of unique photographs, including, in the case of the coronation of the present King, negatives of the ceremony itself in Westminster Abbey. At the time of his death the photographs in his private collection at Erdington, Birmingham, numbered over 25,000, and were sytematically arranged and catalogued. Sir Benjamin was survived by his wife only a few days. Lady Stone was in a serious condition at the time of her husband's decease.

B. J. Edwards.

Mr Edwards's death removed one of the pioneers in dry-plate photography. He was the first to manufacture orthochromatic plates in this country under the Teilfer patent, and the Edwards isochromatic plates were manufactured by him of a quality and of keeping properties which did a very great deal to popularise the use of colour-sensitive materials. At this time the factory was at Hackney, but was subsequently removed to Castlebar, Ealing. Some years ago other interests came into the business, and Mr. Edwards afterwards ceased his connection with it. After being for a time in still other hands, it was acquired, within the past few years, by the Leto Photo Materials Company.

Mr. Edwards throughout his life was a restless experimenter and inventor, not only on the chemical side of photography, to which his business proper related, but in mechanical matters. He originated the method of intensifying plates with mercuric iodide, a process which was perfected many years after by MM. Lumière, but in its original form, nevertheless, provides a useful means of intensification He was a pioneer in the construction and design of instantaneous shutters, at the time when such appliances were

something almost revolutionary in photography. We believe that he was, in fact, the first to construct a working focal-plane shutter. Machinery for the coating of dry-plates also occupied his talent for mechanical construction.

On terminating his connection with the Ealing works, Mr Edwards had taken up his residence at Hayes, Middlesex, where he had built a small factory in which for a time he manufactured a special description of printing paper which for some time was marketed as "Wisto" He is survived by his daughter, Miss Kate Edwards, and his two sons, Mr. Austin Edwards, of Warwick, and Mr. Ben E. Edwards, of Thornton Heath

George Hare.

Mr George Hare's name as a maker of cameras was for many years a household word among photographers of the past generation With the rise in popularity of photography as an amateur pastime the making of cameras in large quantities, largely by machinery, had supplanted makers such as Mr. Hare, and probably many amateur workers of the present day are altogether unfamiliar with his name and work Yet up to the time of his retirement from active business, not many years ago, Mr Hare was regarded as *the* maker of a field or studio camera of the very highest class

Mr. Hare entered the field of photographic apparatus manufacturing when it was in its infancy Born in Yorkshire in 1825, he served an apprenticeship to his father as a joiner, and after obtaining his freedom of the city of York and practising his trade for some years in York he came to London and entered the firm of Ottewill and Collis, then engaged in the manufacture of requisites for the newly discovered photographic art. After remaining a year or two with them he started in business for himself and devoted himself to the exclusive manufacture of the cameras which made his name famous all over the world and secured him medals for excellence of manufacture wherever he exhibited his work. Mr Hare had lived in retirement the last few years of his life, surrounded by his three daughters, who survive him. His son, James H. Hare, emigrated to America, and has made a name for himself as a photographic illustrator and war correspondent. Of good Quaker stock, Mr. Hare was a splendid specimen of an upright, honest, hard-working, temperate citizen. At the time of his death he was in his eighty-ninth year.

Thomas Birtles

Mr. Birtles began his career as a professional photographer over forty-five years ago, and had been established for some thirty years past in Warrington, where, until his retirement some few years ago, he had been actively engaged in a very extensive business, which included within its scope much of the best work in the surrounding district. He was a familiar figure until only a year or so ago in photographic circles, his picturesque dress—he retained the velvet jacket of the old school of photographers to the last—marking him as one of the pioneers in photographic portraiture. He was a member,

and afterwards a Fellow, of the Royal Photographic Society, and for a number of years a member of Council of the Professional Photographers' Association. Both among his professional brethren and in Warrington circles Mr. Birtles was held in high respect and esteem. He was in his 77th year.

F. P Moffat.

Among professional workers Mr Moffat was known not only for his standing as a portraitist, but for his interest in, and work for the Professional Photographers' Association For many years he was Hon Secretary of the Edinburgh Branch of the P P A, and filled the office of President of the Association itself in 1911-12 In that year his presidential address will be remembered by its sound views upon the business policy which should be a photographer's. Apart from the calls of his own business and that of the Association, Mr. Moffat showed a broad interest in photographic matters. He was an active member of the Edinburgh Photographic Society, of which he was twice President, and of which he was a constant supporter, both in and out of office He was a regular exhibitor at the Scottish National Salon, and was an honorary member of the Scottish Photo Pictorial Circle. In him professional photography and the Scottish photographic world have lost one of their worthiest representatives. His death took place suddenly, following an attack of influenza. Pneumonia and pleurisy followed, but Mr. Moffat appeared to be recovering when a sudden heart failure supervened, and he died after an illness of little more than a fortnight

Charles Sawyer.

Throughout the whole of his business life Mr. Sawyer had been associated with the manufacture and supply of the Autotype materials for carbon printing. As a youth he spent a few months in the counting house of the Paris representative of the Company, afterwards entering the London office of the Autotype Company, and becoming a partner in 1884. On the death of his father, Mr. J R Sawyer, and on the subsequent retirement of Mr. Bird, the management of the business devolved solely upon him, and for the last eighteen years the whole of the technical manufacture and the direction of the Autotype Company had been the subject of his daily supervision Of a temperament which showed little upon the surface, Mr. Sawyer's death will be felt by those associated with him, who had constant cause to respect not only his ability but his justice and consideration. At the time of his death he was 53 years of age

K W. Wolf-Czapek.

Herr Wolf-Czapek was best known as editor of "Die Photographische Industrie," the organ of the photographic trade in Germany, which has rapidly reached its present important position very largely through the knowledge and enterprise of its late editor. Since joining this publication some few years ago Herr Wolf-Czapek had actively associated himself in other branches of photographic

journalism. On the establishment of a popular journal for amateur photographers, "Photographie fur Alle," he edited also this periodical, and, in addition, was responsible for the authorship, revision, and editing of a whole series of photographic text-books, among them four volumes dealing with the scientific, technical, and educational applications of photography. Among the technical subjects which particularly engaged his pen as the author of articles and books were cinematography and the technics of the india-rubber industry. Prior to entering photographic circles Wolf-Czapek had been editor of the "Tagblatt" in his native town of Prague, following his student days there in philosophy and law. At the time of his death he was only 36 years of age.

Among others who have been removed by death during the past twelve months are:—M. Bertillon, inventor of the criminal identification system which bears his name; Gustav Cramer, dry-plate manufacturer, of St. Louis, and beloved in photographic circles in the United States, where he was always "Papa" Cramer; Arthur Weston, for many years a photographer in the City of London; Chas. H. Coote, and F. W. Hicks, staunch supporters of the Manchester Photographic Society and the Croydon Camera Club respectively; and J. C Burrow, a pioneer in underground flash-light photography.

EPITOME OF PROGRESS.

BY THE EDITOR

In the following pages will be found classified abstracts of papers, communications, and articles describing progress in technical photography (art topics are excluded) which have appeared in the British and foreign Press during the twelve months October 20, 1913, to October 20, 1914. It may have happened that some foreign journals have not arrived in time for abstraction; their contents will be dealt with in the 1916 ALMANAC.

The general arrangements of the Epitome will be seen from the contents of the ALMANAC, which follows the title-page. Each item is separately entered in the index at the end of the volume, and a list of the journals abstracted will be found at the conclusion of the Epitome.

In a number of cases where information additional to that in the abstract has appeared in the "British Journal of Photography," a reference to issue and page has been given.

I.—GENERAL.

EVENTS OF THE YEAR 1914.

Jan. 12.—Award of the R.P.S. Progress Medal to Mr. W. B. Ferguson for his researches, discoveries, and publications on the physics and chemistry of photography.—("B.J.," Jan. 16, 1914, p. 50.)

Feb. 3 to March 7.—Eleventh Scottish Salon. Held at Aberdeen. —("B.J.," Feb. 20, p. 140, and Feb. 27, p. 159, 1914.)

May 8 to 16.—Photographic Arts and Crafts Exhibition. Organised by Arthur C. Brookes at the Horticultural Hall, Westminster. ("B.J.," May 8, 1914, p. 356.)

May 8 to 16.—Sixth Exhibition of the Society of Colour Photographers. Held at the Horticultural Hall, Westminster. ("B.J." Colour Supplement, June 5, 1914, p. 21.)

May 11 to 15.—Fifth Congress of the Professional Photographers' Association. Held at the Horticultural Hall, Westminster, under the presidency of Alfred Ellis. The proceedings are reported in the

"B J." for May 15, 22, and 29, 1914. A reproduction of a group of members appears as a Supplement in the "B J." for May 15, 1914

May 26 to June 13.—Exhibition of photographs by A. Radclyffe Dugmore at the Royal Photographic Society.—("B.J.," June 5, 1914, p. 441.)

June 19.—Celebration of the Diamond Jubilee of the "British Journal of Photography" by the publication, with the issue of this date, of a Supplement entitled "Photography, Past and Present," and reviewing the evolution of photographic processes from earliest beginnings to the present time.

July 6 to 11.—Twenty-ninth meeting of the Photographic Convention of the United Kingdom. Held at Perth, under the presidency of G W. Atkins. The proceedings are reported in the "B J" for July 10 and 17. The 1915 meeting will be held at Caen.

Aug. 1 to 15.—Outbreak of war between Germany-Austria-Turkey and Great Britain, France, Russia, Belgium, Servia, and Japan

Aug. 24 to Oct. 3.—Fifty-ninth Exhibition of the Royal Photographic Society. Held at the Royal Society of British Artists, Suffolk Street, Pall Mall, S.W. ("B.J.," Aug 28, 1914, p 660) Selecting and Hanging Committees:—Pictorial Section Alvin Langdon Coburn, John H. Gear, H. Holcroft, Furley Lewis, J. C S Mummery, and J. B. B Wellington. Scientific and General Section W. Deane Butcher, Chapman Jones, Dr. C. E K. Mees, Richard Kearton, F. Martin-Duncan, A. J. Newton, and J. W Ogilvy. Colour Transparencies (Pictorial): John H. Gear and H Essenhigh Corke; (Scientific and Technical). W. Deane Butcher, Chapman Jones, Dr. C. E. K. Mees, Richard Kearton, F Martin-Duncan, A. J. Newton, and J. W. Ogilvy.

Sept. 5 to Oct. 17.—Fifth Exhibition of the London Salon of Photography. Held at 5A, Pall Mall East, S.W.—("B J.," Sept 4, p. 675, and Sept. 11, p 688, 1914.)

Oct. 13.—Seventeenth Traill Taylor Memorial Lecture. By J. W Gordon, on "Influence of Diffraction on the Formation of Optical Images"

BUSINESS.

German and Austrian Exports.—A bulletin, issued by the Commercial Intelligence branch of the Board of Trade, 73, Basinghall Street, London, E.C., contains a series of tables showing German exports of photographic goods during 1912, and indicating their distribution in the various markets of the world. Less complete figures also are published in regards to Austrian exports, and the Bulletin contains some tables and notes on the imports of German and other goods into British possessions. The Bulletin is reprinted in "B.J.," Sept. 18, p. 710, and Sept. 25, p. 728, 1914

The Goodwin Film Patent—In the United States Circuit Court of Appeals, on March 11, 1914, judgment was given in favour of the Goodwin Film and Camera Company, a concern owned by the Ansco Company, against the Eastman Kodak Company, in respect to the long-standing litigation connected with the alleged infringe

ment, on the part of the Eastman Kodak Company, of the patent of the late Hannibal Goodwin for the manufacture of rollable film. The decision of Judge Coxe was that the patent was valid, and that it had been infringed. Following the judgment, and pending a further appeal to the United States Supreme Court, a settlement was reached between the Eastman Kodak Company and the Ansco Company, under which the Eastman Company, it is stated, paid a "substantial" sum to the Ansco Company, the amount being supposed to run into millions of dollars An abridged report of the judgment in the Circuit Court of Appeals is quoted, from the "Scientific American," in "B.J.," Apr. 3, 1914, p. 267.

Preventing Proofs Being Toned.—An American photographer, Mr Kerr, of Parkersburg, recommends the following plan for marking proofs, sent out to customers, in order to prevent their being toned and finished off.—Dissolve paraffin in benzine, and take a brush and just make a cross on the face It cannot be seen on the proof, yet when anyone tries to tone it it prevents chemical action.—"B J.," Nov 14, 1913, p. 880.

COPYRIGHT.

Innocent Infringement under the 1911 Act.—A judgment of Mr. Justice Bailhache has made very clear the way in which the Courts interpret Section 8 of the 1911 Copyright Act, according to which, where proceedings are taken in respect of the infringement of the copyright in any work and the defendant in his defence alleges that he was not aware of the existence of the copyright in the work, the plaintiff shall not be entitled to any remedy other than an injunction or interdict in respect of the infringement if the defendant proves that at the date of the infringement he was not aware and had no reasonable ground for suspecting that copyright subsisted in the work

The case was one of literary copyright, but the application is equally to photographs, etc. The judge was emphatic in stating that "Section 8 is no protection to a person who, knowing or suspecting that copyright subsists, makes a mistake as to the owner of the copyright and under that mistake obtains authority to publish from a person who is, in fact, not the owner."—"B J.," Jan. 30, 1914. pp 91 and 79.

HISTORY.

Seventy-five Years of Photography.—In connection with the completion by the "British Journal" of sixty years of continuous publication, the history of photographic processes is narrated in a Supplement, entitled "Photography, Past and Present," issued with the "B J." of June 19, 1914. It deals with the beginnings of photography in the work of Wedgwood; with Niépce and the invention of photo-engraving; with Daguerreotype; with Fox Talbot and the introduction of paper negatives and paper prints; with the inventions of Herschel, Reid, and Bayard in 1839; with negative processes on glass and the wet collodion process of Scott Archer; collo-

dion dry-plates, collodion emulsion processes, and gelatine dry-plates; paper and film in negative-making; silver printing processes; bichromate printing processes, such as carbon, gum, Ozobrome, oil, and Bromoil; iron printing processes—e g, platinotype; colour photography, and photo-mechanical methods The Supplement is illustrated by a number of photographs of the early pioneers in photography and of scenes connected with their labours

Bayard and the Invention of Photography.—M. G. Potonniée, in a paper before the French Photographic Society, has dealt with the work (largely unrecognised) of Hippolyte Bayard, who was one of the earliest photographic workers in France, and exhibited some thirty specimens of a process, invented by himself, in 1839. Bayard's process was one for obtaining positive pictures directly by exposure in the camera. A sheet of paper was immersed in a 2 per cent. solution of ammonium chloride, dried, and then floated for five minutes on a 10 per cent solution of silver nitrate. It was then dried in the dark, and was then exposed to daylight so as to darken it completely. It was then so far ready for use, but could be kept for about a fortnight. To prepare it for exposure it was placed in a 4 per cent. solution of potassium iodide, and then, whilst wet, placed in the back of the camera. Where light fell upon the paper the latter became bleached, and thus the result was a positive. It was well washed, and then fixed in a solution of potassium bromide.

Bayard followed up this invention by devising another process, in which he applied the mercury developer of Daguerreotype to the making of a paper print. He described this second process as follows :—Immerse the paper in a weak solution of sodium chloride. When it is dry float on a solution of silver nitrate dissolved in six times its weight of water. When the paper is nearly dry and protected from all action of light, expose it to vapour of iodine, then in the camera, and then to mercury, as in the process of M. Daguerre, and finally wash in a solution of hyposulphite of soda. When the paper is withdrawn from the camera it is just possible to distinguish some trace of the image, but as soon as the mercury vapour begins to condense on the paper the image is formed as on the metal plate, with this difference: that it is produced in a way opposite to that in the process of M. Talbot.—Paris, November 8, 1839."

M. Potonniée claims, on behalf of Bayard, the distinction of being the inventor of photography on paper.—"Bull. Soc. Fr. Phot," Dec, 1913, p. 366; "B.J.," Jan. 16, 1914, p. 43.

In a leading article in the "British Journal" the work of Bayard is discussed in reference to that of Fox Talbot, who, it is pointed out, was the inventor of a system of making both negative and positive prints on paper.—"B.J.," Jan. 16, 1914. p. 39.

II.—APPARATUS AND EQUIPMENT.

(*Including Raw Materials Used in Photography.*)

The many details of pieces of apparatus published chiefly in patent specifications are not abstracted in this Epitome, as space does not permit of the numerous drawings necessary for their explanation. All patent specifications are abstracted in the "British Journal of Photography," and are entered according to subject and also under the name of the patentees in the index to the yearly volume of that publication, which is issued with the last number of the year or the first of the year following.

Dark Room and Studio.

Covers for Dishes.—E. M Mumford advises the use of tin-plate covers for developing dishes with a large knob fitted in the centre to facilitate handling. A very good one is that sold as a cheap door or cupboard knob; it has a long threaded stem and a back nut, and all the fitting that is required is to punch a hole in the centre of the lid and insert the threaded stem of the knob, screw up the back nut, and cut off the surplus stem. A touch of solder prevents unscrewing, but is not absolutely necessary. A round knob 1¾ in. to 2 in. diameter is most convenient, and is suitable for all tin-plate covers up to 9 x 7 ins.—"Phot.," June 16, 1914.

Washing Negatives.—R F Windoes describes a simple piece of

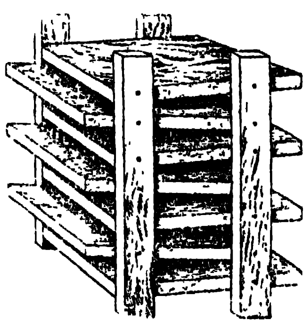


Fig. 1.

apparatus for washing negatives in which the plates are exposed to a constantly fresh stream of water. Fig. 1 shows the construction.

The following dimensions apply to a washer suitable for 5 x 4 negatives. Secure seven pieces of $\frac{1}{2}$ in white maple $5\frac{1}{2}$ ins. wide and 6 ins. long; also four pieces of the same 1 in wide and $8\frac{1}{2}$ ins. long The latter are for the legs and the former for the shelves.

Starting with the front legs, lay off a centre line on each and draw a line at right angles to it $1\frac{1}{8}$ ins. up from the bottom of each leg; $1\frac{1}{4}$ ins. from this draw another, 1 in from this another, and so on until the top is reached, as the drawing clearly shows On the remaining pair do the same, noting that the first cross line is $1\frac{1}{4}$ ins. up instead of $1\frac{1}{8}$ ins., then the 1-in. dimension, the $1\frac{1}{4}$-in, and so on. At the points where the lines cross make a hole through the pieces, using a small awl or hand drill Through these holes insert $1\frac{1}{2}$-in

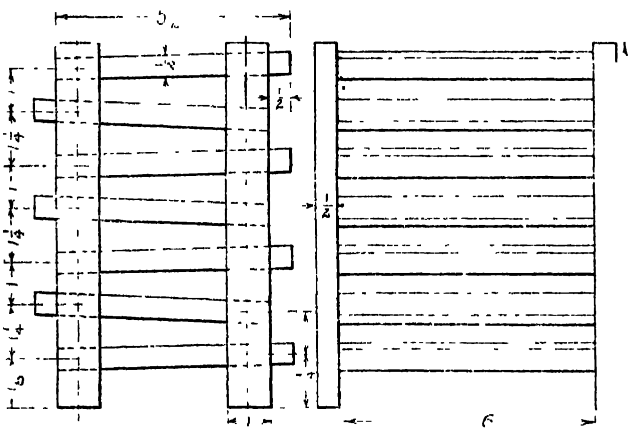


Fig 2

brads, fastening the legs to the shelves through the centre of the edge of each shelf. The higher end of each shelf projects out from the legs $\frac{1}{2}$ in. This allows the water running over it to strike the next shelf at the top and run down to the next, etc. At the lower edge of each water shelf place two small brads, which will prevent the plates from sliding off.

The piece should be painted with about three coats of waterproof white enamel, as the water is very liable to warp the shelves if it is not painted.

In using the washer do not put a plate on the top shelf, as this is merely to let the water flow evenly before hitting the first plate, but insert six plates on the other shelves, place it under running water, and in a short time the plates will be perfectly washed.—"Amer. Phot.," April, 1914, p. 219. "B.J.," April 17, 1914, p. 304.

Blacking Brass.—W. E. Thompson has given the following details for blackening brasswork chemically:—Prepare a solution of copper nitrate by dissolving pure copper in commercially-pure nitric acid until all action ceases. This should be done in a large jar out of doors, as the chemical action throws off a dense brown vapour, which will rust steel or iron, and the volume of the acid increases as it heats. After all action ceases, and the mixture becomes cold, the clear liquid is decanted into another jar.

Sandblast the work, or clean it thoroughly by some other method, so that it is free from grease of any kind. Work washed in a solution of hot lye and soda, dried in sawdust, and then kept from contact with the fingers or grease until the blackening solution is applied will give the best finish.

Heat the work to a temperature of about 212 deg. F., or the boiling-point of water, immerse it in the copper nitrate solution, then remove and heat again until it is just hot enough to dry off the solution, and to burn off the green colour which appears. This process may be repeated if it is thought necessary. The work is then cooled and all free oxide removed by brushing, after which it is dipped in ammonia and rubbed dry with a soft cloth or in sawdust. This will leave the work with a brownish colour.

To get the dead-black colour, heat the piece to a temperature that is not high enough to burn the hands, but very warm, and rub it with a piece of soft leather having a few drops of pure olive-oil on it, after which it should be heated enough to dry the oil. Highly polished work, if well cleaned and dipped in commercial ammonia before applying the copper nitrate, will take a permanent black. Work that is sand-blasted takes a black that cannot be removed by ordinary wear.—"B. J." (from "Machinery"), May 29, 1914, p. 428.

Rocker for Developing Dishes.—H. Ellingworth describes how to make a rocker serving for keeping the developing dish in steady movement for fully five minutes.—Take two pieces of wood, one 15 ins.

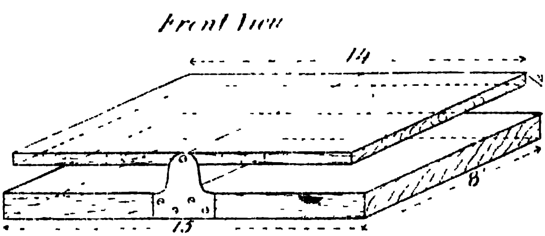


Fig. 1.

by 8 ins. by 1 in., and another 14 ins. by 8 ins. by ½ in.; divide both pieces into halves, and mark, to ensure correct balance (Fig. 1). Take two small pieces of sheet brass (P), drill four small holes in the lower

half for screwing on the bottom piece, and then drill a clean hole in the centre of the top portion. Then screw both pieces on, one

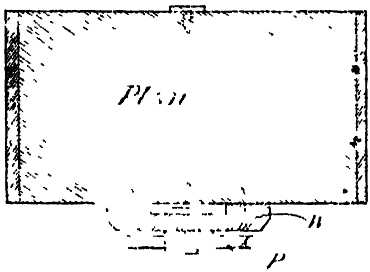


Fig. 2

on each side of the base, care being taken to see that they are opposite one another. Then arrange the top portion to fit in between these pivots, and put a small screw in—to work freely, of course Now cut a small piece of hard wood (W), and fix on the top piece, over the pivot, cutting a small piece away from the pivot, and screw on with two good long screws (Fig 2). Next obtain a small pulley block, such as is used for Whiteley's Exercisers, and screw on to W, the pulley wheel being downwards (Fig. 3). Make a loop of picture cord and pass it over the pulley-wheel, and fix it in a rod or tube about 2 ft. 6 ins. long, connecting the other end of the tube with the weight · Use an ordinary household iron with the handle knocked off, cutting a small piece out and wedging a small iron loop in the thin end. The cord is easily fixed in the tube by tying a knot of both ends and driving a small wooden wedge in to hold them tight.

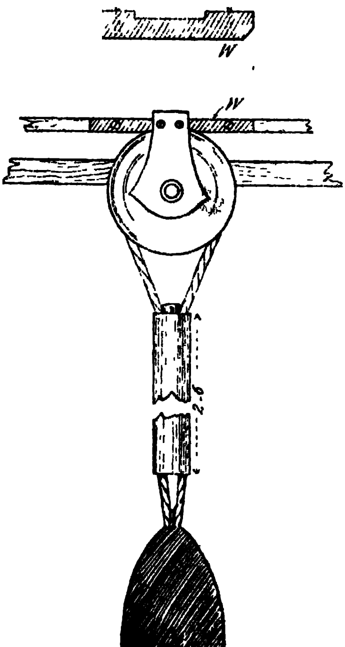
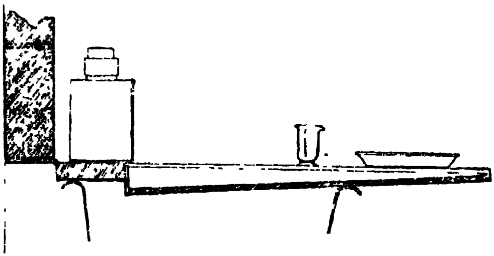


Fig. 3.

The advantage of the tube and pulley is that it will always swing in the same direction, remain rigid, and will not knock against the operator's calves. "B. J.," April 24, 1914, p. 326.

Bath Room as Dark Room.—Orton Holt describes a convenient fitment for the bath room readily converting the bath into a working bench for photographic operations. It consists of a cupboard, or block of shelving, fixed to the wall above the length of the bath and provided with a door which is hinged at the bottom of the shelving and so turns down, forming a flat working bench across



the bath. The door itself is of special construction. It is, in fact, a shallow box, with sides 1½ ins. in height and a bottom sloping slightly from one end to the other. At the lower end are two or three holes from which washings run off into the bath. As shown in the sketch, a top board is laid across the sides of the box, and forms a flat working bench which projects a foot or so beyond the bath, and allows of a sitting position being comfortably taken.—"Phot.," July 14, 1914, p. 34

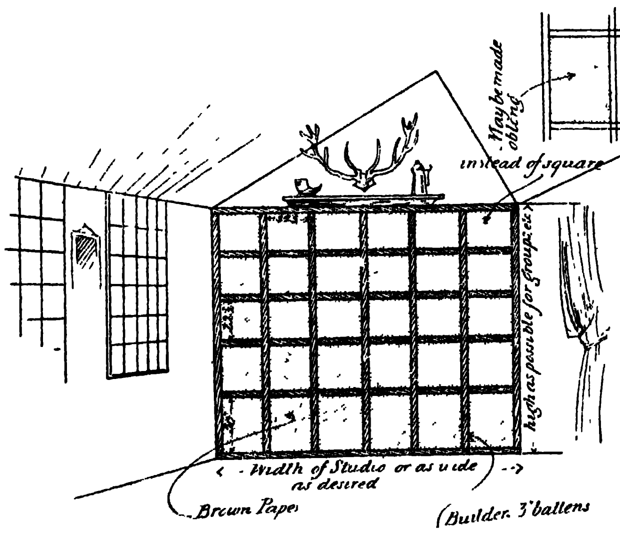
Studio.

Glazing Studio Roof.—J. G. Muse finds that, in the case of studio roofs which are glazed in the old fashioned way, greater watertightness is obtained by snipping off the corners of the panes where they overlap. If the panes are cut straight across there is tendency for the water when it runs down the roof to run along the edge of the glass and into the putty, which causes leakage. When cut away as indicated it always throws the water down. "B.J.," August 28, 1914, 668.

Imitation Oak Panelled Background.—W. H. Lawley describes how to make a cheap and effective substitute for the oak panelled background. Having taken measurements of the width and height

required, to find out how many pieces of wood will be required, allow 2 ft. for each batten, both for height and width. This is for square panelling. For oblong, as shown in the small inset sketch, 3 ft. must be allowed for the upright panel. Order battens of the respective lengths, 3 ins. by ½ in. depth, and when they are delivered, get ready for a start. An ordinary-sized background takes two days to put up, and all appointments should be made accordingly.

Move all backgrounds, accessories, etc., to the other end of the studio, and take up the floor covering, if possible, as well. If it cannot be moved, place something over it—an old, disused background will do admirably. The tools required will be a saw, hammer



and nails. A quite smooth surface on the wall is desirable, and if there are any cracks these should be filled up. A good material to fill up with is plaster of Paris, which is not only cheap, but makes a very hard surface.

Examine all the battens and sort into the different lengths. Start by nailing on the wall, next the floor, a batten of the proper length, and if the wall requires plugging to make it hold, cut off about 2 ins. of the end of a spare batten, split into four pieces, make each one wedge shape and insert in the hole made by the nail. Then knock home with the hammer, and saw off carefully any protruding piece level with the wall. When the batten is nailed again it will hold perfectly. If the wall is brick or plaster-covered it will be absolutely necessary to plug if the background is to be permanent.

When the lowest batten has been fixed satisfactorily a start should

be made with the upright on the extreme left. The battens should be placed at intervals of 2 ft., and great care applied to make sure they are perfectly upright. On the latter will depend the success or failure of the ground. The horizontal battens are placed at the same distance apart except for the oblong panelling. The panel nearest the floor is indicated in the sketch a little larger than the others. The reason for this is that it looks better in the photographs and gives an appearance of the genuine article.

It will be seen from the sketch that the horizontal battens are placed in between the uprights, not laid across. To save time these should all be cut at once and fixed. When finished nailing the next operation is the staining of the battens. with a good dark oak stain, taking care to fill all the cracks, bad joints, etc.

The brown paper is now used to cover up the remaining parts of the wall between the battens, and calls for great care in the fitting. A convenient paste to stick down with is flour and water, rather stiff and free from lumps. Rub down well with a clean duster. There should not be too great a contrast between the oak stain and the brown paper, and it is as well to keep the depth of the stain in mind when buying the paper. When properly made and softly lighted, the imitation background described above will have as good an appearance in the finished portrait as the genuine article, and at a fraction of the cost.—" B J.," March 20, 1914, p. 217.

Supports for Lamps, etc , in the Studio —At a meeting of the Croydon Camera Club, Mr. W. H. Smith demonstrated the use of a novel and most efficient pattern of support, suitable for holding arc lamps, reflectors, or indeed the heaviest description of accessory which a photographer is likely to employ in the studio. While providing an extremely rigid support, the apparatus calls for no permanent attachment to the studio. It consists of one upright composed of two steel cycle-tubes, one sliding within the other, and, within limits, capable of being locked at any height by means of a clamp and screw. To this, radial arms of the same tubing are attached by means of lugs; the arm for the diffusing screen is given a universal movement, the arm for the back reflector being fitted in a somewhat similar way. Two further arms carry the flash-tray and back reflector. These projecting arms remain in any position they may be placed in, without the addition of any clamping device, the leverage exercised by their weight and that of their attachments resisting any inclination to slide down.

The method adopted to ensure the main upright deserving its title is carried out in a highly ingenious manner. A circular wooden disc with upward projecting stem or rod fits into the lower tube of the upright and forms the base. A similar disc with downward stem composes the top, the upper part of this disc being covered with cloth. This disc does not bear on the top of the tube. but normally is held some inches away by means of a strong coiled spring within the tube pressing against the bottom of the stem : the spring itself bears on a stop

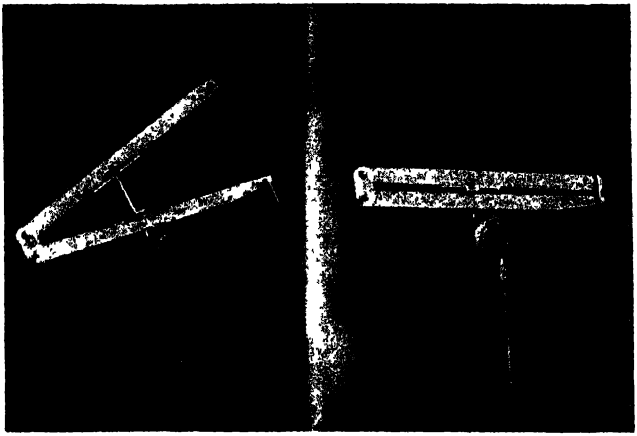
To fix the upright the upper tube is elevated until the disc at

its extremity comes in contact with the ceiling, and a fair amount of pressure is secured between the two by putting the spring under compression; the upright is then locked by tightening the screw. It is quite easy by still further compressing the spring to shift the upright laterally and adjust it to the vertical.

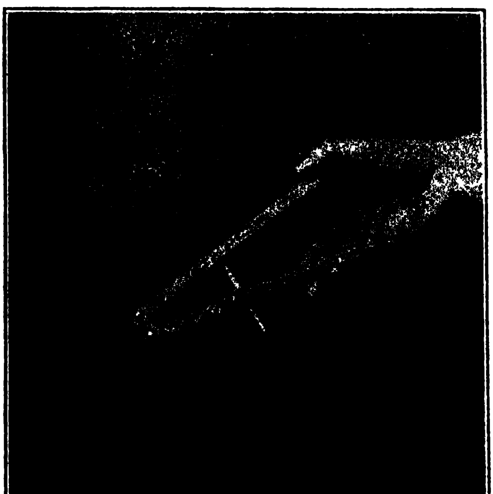
The stability of the apparatus, when set up, is really wonderful, and a violent collision with the upright merely causes the two springy tubes temporarily to bend, without any tendency to shift them. It is the coiled spring which does the trick, for without it a slight displacement from the vertical would cause the whole bag of tricks to come down with a run Mr Smith even hung chairs and a small table at the ends of the radial arms, and pleasantly offered further to illustrate the steadiness of the appliance by stringing up the President, who, however, expressed himself as completely satisfied with the adaptability of the structure for the purpose indicated, without the test suggested. And well he might! for one arm held a side reflector, 8 ft. by 5 ft. 6 ins ; others, the diffusing screen 4 by 2 ft., the reflector behind, 5 by 3 ft., and the flash-tray, and these were by no means so arranged as to balance each other. As another illustration Mr. Smith suspended an 8-ft opaque lantern-screen to one arm, and said that much heavier screens or backgrounds might be carried, if a wire or cord were connected from the end of the arm to the top of the upright With two uprights placed diagonally a complete room might be formed, shut in, if necessary, on all sides. The whole paraphernalia, including a background, packs into a box 6 ft. long by 6 ins. square

A "tip" of another sort given by Mr Smith in reference to the construction of any apparatus, having a component part consisting of one tube sliding within the other, may usefully be mentioned for the benefit of the mechanically minded. Usually the fit between the two is a tight one, and a small dent in the outer tube may result in the inner refusing to "move on," even when forcibly directed so to do. To avoid this, the inner tube can be allowed a considerable amount of clearance, say, 1-32 in. all round, its inside end being expanded so that it will just slide easily in the outer tube. The other bearing surface is made by soldering a short length of tube inside the free end of the outer tube, the wall thickness of the former being adjusted to the clearance It is obvious that if the outer tube is, by chance, dented, that the expanded part of the tube within has, so to speak, far more "give and take" than a tightly fitting tube in the alternative construction almost invariably adopted Moreover, with two tightly fitting tubes, a dent in the exterior one may mean a corresponding dent in the inner, aggravating the trouble —"B. J.," Dec 12, 1913, p 958

Antinous Release for Studio Shutters.—Reid Brothers describe a simple attachment to the Antinous release, as fitted to the heavier forms of studio shutter, for the purpose of giving more power in operating the shutter. As will be seen from the photograph the attachment consists of a pair of hinged wooden bars between which the Antinous release is mounted. When not in use the attachment



The push of the release is placed across the handles at a slight angle.

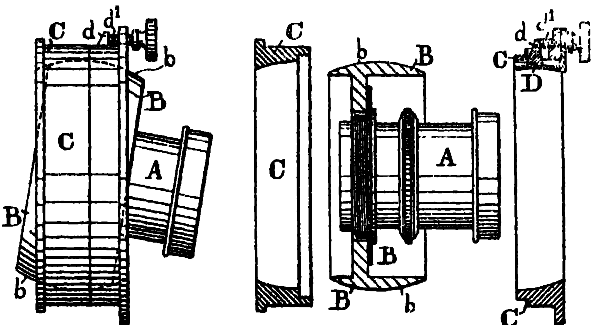


X, wire used to close, and also prevents slipping out of operator's hand.

hangs on hooks under the table of the camera stand.—"B.J.," May 29, 1914, p. 431.

Lenses and Photographic Optics.

Lens Mounts.—A patent taken out conjointly by the Thornton-Pickard Manufacturing Co., Ltd., A. G. Pickard and F. Slinger, describes a new form of lens mount, permitting of the lens being swung, or tilted, and, at the same time, of being held fixed in any position. The holder to which the lens tube A is attached is made in two or more parts—preferably two, an inner B and an outer C. The inner part B to which the lens tube A is directly attached is formed with a convex spherical surface *b* and the outer part C with a concave spherical surface forming, when put together, a universal joint.



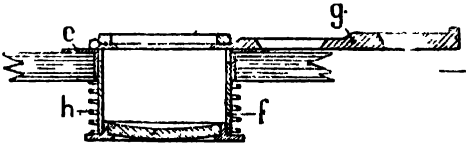
The outer part C of the mount is attached to the camera front and is divided into two parts connected by a screw, bayonet, flanged, or other joint to permit of the inner part B being inserted therein. It is preferably divided as shown, but may be divided in a plane at right angles thereto.

A clamp D is fitted to the outer member to lock or fix the two parts in any position with the optical axis of the lens at the desired inclination. The clamp D is hinged to the rim and formed with a lug or projection *d* against which a set screw d^1 passed through the flange of the mount can abut and press the clamp against the spherical surface *b* of B. Means such as screws or racks and pinions may be provided for the mechanical movement and adjustment of the members B and C to one another.

In the form at present preferred C is fixed to the camera front and the lens A fitted to B, though the arrangement might be reversed and the inner part be extended at one side to attach to the apparatus, and the outer part be extended to permit of the lens tube being fitted to it.—Eng. Pat. No. 2,231, 1913. "B.J.," April 3, 1914, p. 271.

Automatic Aid to Depth of Focus in Fixed-Focus Cameras.—M. G. Cromer has described a method according to which, when changing the stop of a fixed-focus camera from larger to smaller, the focus

is at the same time automatically changed to a nearer plane, thus obtaining the maximum depth whatever stop is used. One mechanical form of the device is as follows:—In the drawing, *f* is the lens, which can be moved forwards or backwards in the tube *e*. A coiled spring, *h*, tends to thrust it constantly backwards. The plate, *g*, in which are the diaphragm apertures, is mounted in the lens barrel to slide to and fro. But this plate offers at each smaller stop a greater thickness, the difference in thickness from one stop to the next representing the necessary extension of the camera, which is necessary in order that the extension shall correspond with the hyperfocal distance due to the particular stop. These extra thicknesses



of the plate are turned towards the front of the lens. They form cams and draw the lens forward each time that the stop is changed from a larger to a smaller one. On the other hand, when the change of stop is made in the opposite direction, the lens is moved backwards under the influence of the coiled spring.

The device thus ensures the lens being focussed on the hyperfocal distance corresponding with the stop actually in use, with the result that the maximum possible depth is secured, and the extreme distance is not rendered more sharply than it need be.—"Bull. Soc. Fr. Phot.," May, 1913. "B.J.," Dec. 12, 1913, p. 950.

[It should be noted that while M. Cromer's proposed adjustment deals admirably with the question of depth it will, in the many cases where depth is of small moment, and full exposure the first consideration, have exactly the wrong effect. In hand-camera work exposure is a very important matter, and it is often necessary to open out the stop for near objects; that is to say, as the camera is racked out the stop has to be enlarged, which is precisely the reverse motion to that produced by the new depth device. The requirements of exposure and those of depth are, therefore, conflicting and we are inclined to think that an automatic device whereby the stop enlarges as the focus is reduced, or as the camera is racked out, would, in practice, prove more serviceable than M. Cromer's device, which has just the contrary effect. It would be very useful to put the matter to a practical test, but unfortunately the device we suggest does not as yet exist.—Ed "B.J.A."]

TELEPHOTO LENSES.

Telephoto Camera Scale.—Capt. O. E. Wheeler has patented a special form of mount for a telephoto attachment and the use in conjunction with it of a scale indicating the camera extension required for any given magnification. The telephoto mount is constructed in three parts: (1) an ordinary tube mount with a rack

and pinion or other adjustment, the usual front cup adapter to carry a positive lens, and a rear adapter to take a cell or cells carrying a negative lens or lenses, the whole screwing into an ordinary flange (Fig. 1); (2) a cell letter F (front), carrying a negative lens of specially selected focal length and diameter (Fig. 2); (3) a cell lettered R (rear), also carrying a negative lens of specially selected focal length and diameter (Fig. 3). Both the cells are arranged to

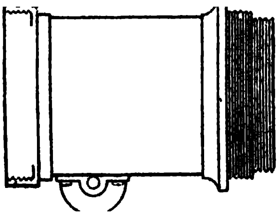


Fig. 1.

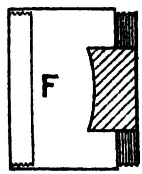


Fig. 2.

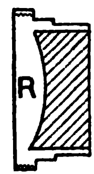


Fig. 3.

screw on to the rear of the tube mount, and the rear cell can also be screwed on to the rear of the front cell. When the latter adjustment is made a third negative element is formed, having a very short focal length, with, on the surface next to the sensitive plate, a relatively large diameter, giving relatively increased covering power

In a tube-mount of this description for from 5 ins. to $5\frac{1}{2}$ ins. positives a range of extension by rack and pinion or other adjustment of about 1 in. is provided. The F cell is mounted to give an additional separation between the positive and negative elements of about $\frac{3}{4}$ in When the R cell is screwed on to the F cell the separation between the two negative lenses is infinitesimal.

As an example, in the quarter-plate model the F lens is a Ross tele-negative of $1\frac{3}{4}$ ins. focal length, and the R lens a Ross tele-negative of $2\frac{1}{4}$ ins. focal length. The diameter in each case is approximately half the focal length. When the R and F lenses are compounded the resultant focal length is approximately 22 mm.

By using the R lens for 4 and 5 magnifications, the F lens for 6 and 7, and the R and F lenses compounded for 8 magnifications upwards, a range of about ten magnifications is secured with about 12 ins. camera extension.

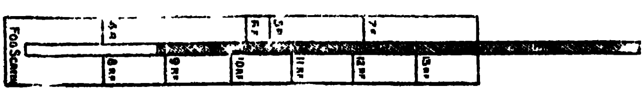


Fig 4.

With the above described mount and combination of negative lenses is used a camera scale or indicator (Fig. 4). This in its usual form is a boxwood strip, in which slides an inner strip of ebonised wood, with a white double arrow marked on the lower end. On the outer strip at due intervals are marks with figures denoting magnifications from 4 to 13, and if the inner black strip is pushed

out till the white arrow is opposite one of these marks, then the distance from the bottom end of the boxwood strip to the tip of the ebonised strip is the distance which the front panel of the camera must be from the focussing screen in order to produce the marked magnification. Moreover, at each mark denoting a magnification the letter R, or the letter F, or the letters RF are printed, indicating that for this magnification the R lens or the F lens, or the RF compound lens should be used.—Eng. Pat. No. 4,733, 1913. "B J.," Apr. 10, 1914, p. 289.

Cameras and Accessories.

Reflex Cameras.—M. Ganzini has patented a design of reflex camera, in which the mirror is permanently fixed, and both reflects and transmits light. Two images of the subject are thus formed—one (usually) on the top of the camera; the other, at the back, opposite the lens. The reflected image is used for exposing the sensitive plate, whilst the transmitted image serves for focussing. The object of the design is to avoid the jar caused by mirror movement, and also to allow the camera being used at the eye level. The design is also applicable to studio cameras, the operator being able to work in the ordinary way and focussing and arranging the subject up to the instant of exposure —Eng. Pat, No. 2,602, 1913; "B.J.," Oct. 31, 1913, p. 846.

A Home-made Shutter Bulb—F. W. Hudson describes, as follows, how to extemporise a pneumatic bulb for a shutter, such as a Thornton-Pickard, in circumstances where it is not possible to obtain a new bulb:—Secure a piece of inner tube of a bicycle tyre and cut out a piece of the desired size (as Fig 1), then scrape with a penknife very clean on edge to dotted lines; then fold clean sides in (as Fig 2) Then take a small sewing-needle (cambric needle is the best) and sew the edges together with the over and under stitch—the

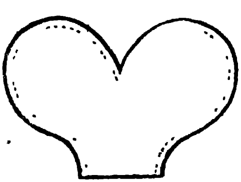


Fig. 1.

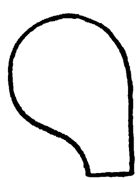


Fig. 2.

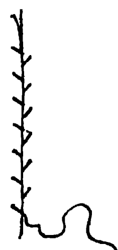


Fig. 3.

stitch that is employed in securing the cover on a baseball (Fig. 3). This will bring the edges fairly square together, make the stitches small and close together.

Now take a tube of bicycle rubber cement and insert a small quantity into the bulb. Put air pressure on the bulb till a few small

particles of cement are visible on the outer edges of the bulb; then put a heavy coating around the outer edge of bulb on seam and let set overnight. Open the neck up with a small object and fit on shutter; wrap the neck well with silk thread and you will have a bulb equal in service to the best —" B J.," June 5, 1914, p. 445.

III.—PHOTOGRAPHING VARIOUS SUBJECTS.

Portraiture.

Portraiture with Half-watt Osram Lamps.—In a demonstration before the Croydon Camera Club W. H. Smith and E. A. Salt showed the efficient and convenient properties of the half-watt metallic-filament lamps, newly introduced by the General Electric Company, Limited. They explained that, in consequence of the exceedingly high temperature which the filament was capable of sustaining, the lamps were most economical of current, consuming half that of the ordinary pattern of metal-filament lamp. The life of the lamp is about 1,000 hours continuous burning, during which time there is a gradual decrease in the light of about 15 to 18 per cent.; but, omitting this gradual drop, which could always be allowed for, the light from the half-watt lamp is quite constant, in this respect being unlike arc lamps, which fluctuate, sometimes seriously. With so many types of arc lamps no firm figures could be given, but variations of 50 per cent. at a given angle might occur with some types. Arc lights could never be relied upon for printing by time; in this respect the mercury-vapour lamps scored heavily, also in other directions. As a general rule there was not much to complain of as regards variation of voltage in currents from the main, and this was lucky, as uniform light with the new lamp depended upon a uniform voltage. It was stated that the variation in candle-power due to voltage variation was in the ratio of 3.8 times the voltage. For instance, for a variation of 10 per cent. the variation in candle-power would be 44 per cent. Compared with carbon filament lamps this is not so great; for this type 10 per cent. variation would mean 50 per cent. variation in candle-power.

The lamps are sold in various voltages, from 200 to 3,000 candle-power, the lowest candle-power on a 200 to 260-volt circuit being 1,000. At first sight it might be thought that the same principle might be applied to all tungsten lamps of low candle-power, but a

little thought would show that there were serious difficulties in the way—at all events, with high-voltage lamps. High-voltage lamps of low candle-power required filaments of high resistance, which, in turn, demanded a very fine tungsten wire indeed. The same resistance might be obtained with a thicker and longer filament, but this would defeat the object aimed at, as the increased length would mean added light. Probably there was a certain minimum size filament which would stand being overrun, even in nitrogen; hence the limitation arose.

It was interesting to compare the latest comer with some other forms of electric illuminants The carbon glow-lamp absorbed about 4 watts per candle-power; some higher efficiency ones less. The ordinary tungsten Osram lamp takes slightly over 1 watt. The mercury-vapour lamp in practice on continuous current absorbs .38 watt. With alternating currents a transformer and rectifier are necessary, and reduce the efficiency. The efficiency of an arc lamp is dependent upon its type, the mean candle-power per watt from an authoritative source being as follows:—Open arc, 2.14; enclosed arc, 1 26; flame arc, 4 31. The enclosed arc is, therefore, the least efficient visually, but this standard, of course, does not mark its actinic power.

Unfortunately, there had been very little time available to make practical test exposures in portraiture. With a tracing-cloth diffuser placed in front of the 2,000-c.p. lamp, about 4 ft. from the sitter, an exposure of one-third to half a second at *f*/4 gave a fully exposed negative on a Flashlight plate. With a screen of paper of about the same opacity as medium thin notepaper—as used for writing upon, not the thinner variety employed for typed letters—an exposure of one second gave a fully exposed negative He estimated that the paper cut off about 60 per cent. of the light. It must always be borne in mind, Mr. Smith said, that an intense illuminant, well diffused, gave much better modelling than a feebler illuminant of the same character, lightly screened.

The new lamp would prove a serious rival to the arc-light and mercury-vapour lamp for portraiture, as its strong points were many, not the least being low first cost—a 2,000-c p. lamp being priced at £2, a 3,000-c.p. at £2 10s. The light, if screened, was of agreeable character, and would permit of the use of ortho' plates and screens. The constancy of illumination made correct exposure easy. No electrical knowledge was necessary to manipulate it, and even the highest candle power lamp, probably, could be connected to most branch circuits with safety, provided they were not fully loaded with other lamps. The bulb was much smaller than the older type of high candle-power lamp, was very light, and with a suitable appliance it quickly could be adjusted to any position without troubling the sitter to move; special lighting effects were also very easily secured.

The lamp can also be used for printing, though apparently it would not be so economical in use as mercury-vapour. At short distances the radiant heat from the lamp made the negatives unpleasantly warm. Some few trials have shown that about the best distance was 14 to 15 ins. from the centre of the bulb. At

10 ins. distance the printing value for platinum paper was about the same as average summer diffused light. With a medium negative 5 minutes at 10 ins. was sufficient, and the temperature of the air close to the frame rose from 60° to 80° Fah., which would do no harm, but at 10 minutes the thermometer registered 100°, which was too high. At 4 ins. from the centre of the bulb the exposure was 1 minute. At 14 ins. it was 13 minutes.—"B.J.," Feb. 20, 1914, p. 135.

In a further paper and demonstration, given before the fifth Congress of the Professional Photographers' Association by W. H Smith, E. A. Salt, and C. F. Trippe, the properties of the new half-watt lamp of the General Electric Company were fully described in relation to the use of the lamps for studio portraiture. At present the lamps are made for voltages from 50 to 250 and of candle-powers from 600 to 3,000.

The great constancy of the light was one of its strongest points, leading to correct exposure of plates in the camera and reliable work in the printing from negatives. There *was* a slight gradual falling off during the life of the lamp, but it was known, and allowance could be made for it. Moreover, the lamp was entirely free from chance hissings or fluctuations, such as doubtless had annoyed many users of arc lamps by their occurrence at the instant of exposure.

As regards the cost of illumination with the half-watt lamp, this compared favourably with other systems, assuming an average life of the lamp of 800 to 1,000 hours. The lamps would last much longer than this time, and the consumption of current would also be less, if the maximum light were used only for the actual exposure. Where there were several lamps some of them may be left unlighted until making the exposure, whilst an alternative plan, applicable both to one lamp and to several, was to employ a resistance on the circuit during the preliminary operations. If the light were thus reduced to about one-third for focussing and the maximum illumination employed only for taking, then for all practical purposes the average life of the lamp could be taken as the total time of burning at the maximum intensity.

The design of the lamp afforded a very uniform distribution of the light, and as the filament was arranged within a small area, the distribution of light might be very effectively controlled by reflectors. The lamp being of small weight, it could be readily mounted and as readily moved about in the studio to secure lightings of different kinds.

Moreover, the lamp also formed an efficient light for printing. In this respect it was probably not equal to the mercury-vapour, particularly in the printing area available, but it cost much less, particularly in cases where alternating current had to be used—that is, when a rectifier and transformer required to be employed with mercury-vapour.

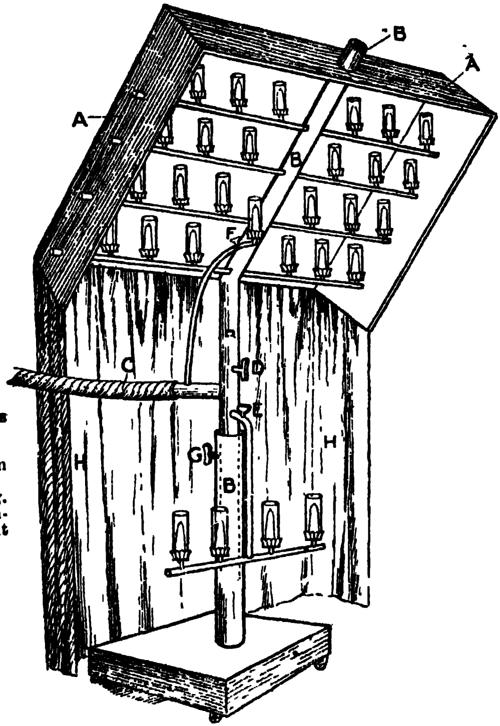
Mr. Salt emphasised the three main points in favour of the lamp for artificial-light portraiture—namely, its convenience, cleanliness, and great simplicity in working. It called for no adjustments and required no knowledge of electrical matters. It was adaptable to

fittings which might be elegant in appearance, and so be fittingly employed in studios to which it was desired to impart the appearance of an ordinary living room. He showed a two-lamp installation, supplied by Messrs Marion and Co., on the well-known Boardman system, the light being used entirely by reflection. Passing to compare the half-watt lamp with other forms of electric light, he said that the light, actinic as it was, candle-power for candle-power, was admittedly not equal to the arc as regards chemical or actinic rays, but it was considered that the actinic effect of the light was sufficient for almost every requirement, whether the light was used either direct or by reflection. Personally the authors of the paper were inclined to favour the direct method as providing greater variation of lighting effects. As a rough idea of the necessary exposures, one second at $f/8$ on a rapid plate was named as sufficient with a 3,000 candle-power lamp about 6 ft. from the sitter and well diffused with tracing cloth. The lamp would also be of great service in professional home portraiture. Using a lamp taking about five amperes of current, it could be connected to a holder without injury to the circuit, for use either as the sole source of light or as supplementary to daylight. A light of the highest power would hardly be required for this branch of work where exposures of fair length could usually be given. It was mentioned that successful Autochrome portraits had been taken with one 3,000 candle-power half-watt lamp, screened with tracing cloth, in a time of fifteen seconds, with a lens working at $f/3$ Such exposures could be greatly reduced by extra-sensitising of the plates or by using more light. Satisfactory exposures had been made on the Paget colour plate with a lamp more lightly screened and placed nearer to the sitter in about four seconds at $f/4.5$. The authors referred to the first commercial application of the lamp for studio portraiture—namely, that of Messrs. Sichel, and embodying six 1,000 candle-power lamps, using a direct illumination screened. In conclusion, the authors expressed the view that the new lamp would fill a place, and a most important place, in portraiture by artificial light. It was not easy to say to what extent it would supersede other forms of illumination, but photographers were in the happy position of being able readily to make trial of the lamp, since in most cases it could be adjusted to existing fittings.—"B.J.," May 22, 1914, p. 404.

A. Lawton Jones describes his experience of the half-watt lamp during six months' regular use. Using a 3,000 candle-power lamp, entirely by reflection from a V-shaped reflector, he found that exposures with $f/8$ on plates of 400 H. and D. speed averaged about two seconds, whilst as regards the result there was scarcely any inferiority to those obtained by daylight.—"B.J.," June 26, 1914, p. 505. (See also p. 446 of this volume.)

Studio Gas Lamp.—H. Essenhigh Corke has described the construction of a gas lamp for studio portraiture, the general features of which are seen in the drawing. The lamp carries twenty-four ordinary upright incandescent burners, placed in four rows, and separated about 7 ins., each row being about 1 ft. above the row

beneath it. The general supply pipe is of 1 in. diameter, the arms being ½-inch gas pipe. In a later construction of lamp inverted mantles were used in place of the upright ones, but to the number

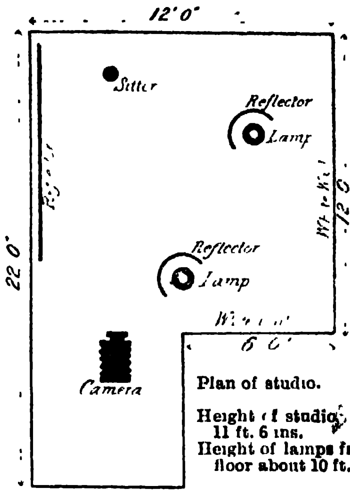


A, Zinc reflector
B, Main 1-in. gas-pipe.
C, Connection with gas main.
D, General tap.
E, Tap for four bottom lights.
F, A light for focussing.
G, Screw to hold standard at any height in base.
H, White sheet.

of only sixteen. With this pattern exposures at $f/5.6$ averaged two to four seconds. "B.J.," Aug. 21, 1914, p. 647.

Studio Lighting with Half-Watt Lamps.—Messrs. Hodgsons describe the arrangement adopted by them for the lighting of the studio for portrait photography entirely with two of the 3,000 candle-power half-watt lamps. Each lamp is fitted with a curved reflector placed at an angle of 45 deg., and reflecting the light partially on to the white ceiling. The reflectors are curved just sufficiently to shade all direct light from the lens. In addition a large reflecting space is placed on the side of the studio opposite to the lamps. The lamps are arranged on separate switches, so that one only need be used if so desired. It is necessary to make provision for a little frontal reflection, as it is almost impossible (in an

average-sized studio) to diffuse the light to such a high degree as daylight is, for obvious reasons Deviation from the "straight" lighting can be obtained by the employment of dark blinds over the



Plan of studio.

Height of studio, 11 ft. 6 ins.
Height of lamps from floor about 10 ft.

large reflecting surfaces, and by altering the direction of the lighting with the aid of the small reflectors round the lamps; also by using only one of the lamps—"B.J," Aug. 7, 1914, p. 618.

Copying.

Copying Objects in Low Relief.—In copying such objects as medallions, inscriptions on cups, etc., a very effective method is to use the unscreened light of the arc lamp, placing it on one side so as to give the maximum of contrast in illumination. The room should be darkened except for the light from the arc No doubt a similar result may be obtained by daylight, employing a highly concentrated source of light such as is used in taking firelight portraits. —"B J," June 19, 1914, p 482.

Copying Half-Tone Illustrations.—E. J. Wall recommends, for the avoidance of the half-tone structure in copies of illustrations printed from half-tone blocks, the use of a very fast plate, using an ordinary developer so as to avoid harshness in the negative. The latter are thus obtained free from dot formation. To obtain prints or lantern-slides of necessary vigour from these negatives, material coated with hard-working emulsion requires to be used.—"Photo-Era," Feb., 1914, p. 77.

Finger Prints.—A writer in the "Scientific American" has described a method of rendering visible finger prints as a black or brown-black impression instead of the white impression obtained by the usual method of sprinkling talc or aluminium powder over the suspected spot. If a finger print is made upon a piece of hard-surface paper, or an impression of the thumb, or both, a very fine powder of dried acetate of lead may be scattered over the places where these impressions have been made, and then the paper should be tapped so as to free the surface of the superfluous powder, after which the spot should be submitted to the fumes of sulphide of ammonium.

The markings will then develop immediately into bold clear lines of a brown-black colour, due to the formation of sulphide of lead If finely powdered dry chloride of silver be used instead of acetate of lead, the surplus powder being removed in the same way by tapping the paper, it will be found that on exposing the paper to the action of light (sunlight if possible) the finger prints will develop perfectly. From these developed impressions a negative may be made and prints made therefrom, either by direct printing or by development. It has been found by testing that if the paper employed for this class of work is coated with plain collodion so as to make it non-absorbent the impressions become very brilliant, and can be fixed by floating the paper back down upon a mixture of sulphuric ether and alcohol in equal parts, the penetration of which softens the collodion surface, causing the sulphide of lead, or re duced silver chloride to adhere. A finger print upon a glass tumbler, a glass pane, or upon office brass work can be brought out distinctly in black by placing a piece of white paper in the tumbler in cylinder form. A negative can be readily made from the impression. Acetate of lead appears to give blacker impressions with the sulphide of ammonium.—"B.J.," Nov. 21, 1913, p. 903.

MISCELLANEOUS SUBJECTS.

Photographing Flowers.—H. Evinson finds the most useful means of supporting cut flowers for photographing is a basin filled with damp sand in which the flowers can be arranged in any way, the moistened stand keeping them fresh.—"Phot.," June 16, 1914.

Photographing Dogs.—H. M. Kellam, in making large head portraits of dogs, finds the best plan to be the use of a lens of about 7½ inches focal length placed about 6 ft. from the subject. This gives a good amount of depth of focus and yields an image in which the head measures from ¾ to 1 inch across. He uses half-plates, and so has plenty of margin for chance movement of the animal. The head portion of the negative is afterwards enlarged to give a print of about 6 x 4 inches. In this way it is found that the results are better than by attempting a large-size head direct.—"A.P.," Sept. 21, 1914, p. 273.

Reflex Camera at the Eye Level.—"S. H." describes a modification in the hood of a reflex camera by which the camera can readily

be held level with, or above, the head, as shown in Fig. 2, in comparison with the usual lower position, Fig. 1. Instead of the usual deep hood, it consists of a wedge-shaped hood, underneath the top part of which is fixed a mirror, so that in this mirror is seen a reflection from the ground-glass at the top of the camera. This arrangement is very useful when working in a crowd, as it enables one to work over the heads of the people as well as to avoid near and consequently distorted objects. Before fixing this arrangement the camera was used upside down when wanting a high view-point, but for various reasons this was found unsatisfactory. The "business"

Fig. 1. Fig. 2.

side of the camera is usually made for the right hand, consequently everything was reversed. Further, unless the mirror is held in position (normally) by a catch and released by pressing a knob—and very few are—it will be found a trying and even risky proceeding to use a reflex upside-down. Most of these cameras are so made that the mirror has to be levered up for exposures, consequently when using it reversed the mirror has to be *held down;* its own weight will cause it to fall and expose the plate at the right (or wrong) moment. Some three or four reflexes have the catch-and-spring release; with this it is possible to give slower exposures with less risk of moving the camera.—"B. J.," October 31, 1913, p. 842.

IV.—NEGATIVE PROCESSES.

The Gelatino-Bromide Process.

PLATES AND EMULSIONS.

Packing Exposed Plates—W. J. Field recommends the following method in which strips of filter paper, about 20 ins. long by 4¼ ins. wide, are used for quarter-plates. One plate is placed face upwards in the plate box, and one end of the strip is laid upon it. On this are placed two plates, back to back, and the strip is folded back over the film of the upper one. Then two more plates are put in back to back and the strip is folded back and so on until the box is full. One thing to mention is never to use an end of the strip which only partly covers a plate. If it will not go all over it, tear it off and start afresh. The box should be a little more than full, so that when its lid is put on the plates are kept well pressed together. The box must be wrapped in black paper, pasted down, or light may get in at the corners. The method is one which is easily followed in a dim light. The strips should be cut carefully to size beforehand, and carried rolled up, not folded.—"Phot.," June 30, 1914.

Non-Reversing Emulsion.—R. E. Crowther has patented the use of certain compounds as additions to a dry-plate emulsion, or as a a bath for application to dry-plates, for the prevention of reversal by excessive exposure. It has been found by the patentee that if a film of silver haloid be bathed with a solution of para-di-amido-benzene (commercially known as para-phenylene-diamine)—which is an active halogen absorbent used for the development of the invisible image, and in which the active amido groups occupy the para position in the benzene ring—or its salts or its methyl substitution derivatives in which the methyl group or groups is, or are, in the side chain or nucleus or both, or of a salt of such a methyl substitution derivative, gross over-exposure up to the stage of printing out may be given without reversal taking place, and that on suitable subsequent development an image can be produced in which the quantity of silver is practically proportional to the light-action. Moreover, the para compounds or derivatives and products resulting therefrom by the action of light need not be removed from the film by washing or other means prior to development.

Thus any ordinary sensitive photographic plate or film is immersed in a solution made by dissolving one part by weight of

para-toluylene-diamine-hydrochloride (which is the hydrochloric acid salt of a mono-methyl derivative of para-phenylene-diamine, having the methyl group in the nucleus), preferably freshly prepared, and one part by weight of sodium sulphite crystals in 75 parts by weight of distilled water, adding to the solution so obtained one-third of its volume of ethyl alcohol. The additions of sodium sulphite crystals and ethyl alcohol are not essential, but preferable, as they have a preservative action.

The plate or film is left in this solution for a period of time sufficient to ensure uniform penetration of the coating, the time of immersion varying, according to the nature and age of the emulsion being treated, from, say, thirty seconds to two minutes. The plate or film is then lifted from the bath, and after removal of the excess of liquid from the sensitive surface put to dry, the whole of the above operations being conducted in light to which the emulsion is not sensitive, or in absolute darkness. When dry the plate is ready for exposure.

If it is desired to prepare a gelatine emulsion possessing non-reversing properties the solution may be added to the emulsion immediately previous to coating, in the proportion of 120 c.c.s. to every 20 grams of silver contained in the emulsion.

In order to take full advantage of the property of non-reversibility imparted to the emulsion by the addition of the solution, and to produce at the same time an image in correct or practically correct gradation when exposures grossly exceeding the minimum necessary to produce an image developable in the ordinary way have been given, it is essential to apply a developer which acts slowly. Eng Pat. No. 29, 919, 1912.—" B.J ," Jan. 30, 1914, p. 86

Treating Dry Plates for Over-Exposure.—Raymond E Crowther, in a paper before the Royal Photographic Society, discusses at length the theoretical considerations which led him to devise a chemical treatment of gelatino-bromide emulsion by which the latter was rendered very greatly immune to the reversing effects of over-exposure. Addition of certain chemicals is made to the emulsion, either before coating or by means of a bath in which the coated plates are immersed or by which they can be more simply treated with a Blanchard brush. The first substance tried was para-phenylene-diamine, which, however, has the drawback of oxidising rapidly in the air, yielding coloured compounds which reduce the speed of the emulsion. Also, in presence of moisture, it is liable to fog the plate before exposure. A further compound was prepared free from these defects, which arise from the presence of free amido groups, but it was found so slightly soluble in cold water that it could not be used as a bath for plates, though suitable for addition to emulsions. Still another compound was prepared of sufficient solubility and yielding plates which underwent no change during at least two months In applying the solution to plates the best method is immersion for about five minutes, but the solution may be brushed on with a camel-hair or Blanchard brush, the plates being afterwards dried assisted by gentle heat. Mr. Crowther accompanied his paper by the exhibition of a large

number of slides showing the excellent results obtained in the photography of interior subjects with windows directly illuminated by strong light as regards retention of the detail in the most strongly exposed portions.—"Phot. Journ," June, 1914, p. 250; "B.J.," July 10, 1914, p. 535.

Orthochromatic Processes.

Screen-Plates as Tests of Orthochromatic Effect.—F. J. Hargreaves points out the usefulness of the Paget taking-screen for colour screen-plate work as regards providing a ready means of showing the degree of orthochromatic effect which is obtainable on a given plate with a given light-filter. The plate is exposed behind the taking-screen, the filter to be tested being placed on the lens. In the case of an ordinary plate (without a filter) the colour positive obtained is in shades of blue-violet, reds appearing black and blue sky and white clouds, of the same shade of blue. A similar effect is obtained when using an ortho plate without a light-filter, some slight rendering of green being at times recognisable. With ortho and panchromatic plates the effect of various filters in securing proper rendering of colours is likewise actually seen by making a negative through the taking screen and from it preparing a colour positive.—"Phot.," Feb. 10, 1914, p. 100.

Pinachrome-Violet Red Sensitiser.—Dr. E. König has described a new colour sensitiser, worked out in the laboratories of Meister Lucius and Bruning. It is a true cyanine dye, and, therefore, suitable for use with other true cyanines, such as orthochrome and pinachrome, without the sensitising effect of each individual dye suffering when they are mixed. This new dye may be combined with orthochrome, or pinachrome much better than may pinacyanol and yields panchromatic plates which, for the same degree of green-sensitiveness, possess enormously greater red-sensitiveness than plates prepared with pinachrome. The absorption spectrum of pinachrome-violet in alcohol consists of a broad band, the nucleus of which extends from about 620" to 590$\mu\mu$, and gradually tails off to about 550$\mu\mu$. The absorption spectrum of pinacyanol in alcohol exhibits two sharp bands, one from 620 to 590$\mu\mu$, and another from 570 to 550$\mu\mu$, whilst the absorption spectrum of pinachrome likewise shows two bands, one strong, from 590 to 550$\mu\mu$, and one weak, from 540 to 510$\mu\mu$. Pinachrome-violet, from its mode of preparation, is undoubtedly a true isocyanine and, therefore, extremely sensitive to acid. If the solution in alcohol is diluted with much water the dissolved carbonic acid suffices to convert the blue-violet colour to one of pale red, whilst on addition of acids the solution is immediately decolourised.

As regards its mode of use pinachrome-violet corresponds completely with pinachrome. For the preparation of panchromatic plates the following is the sensitising bath:—

Alcohol	100 c.c.s.
Water	200 c.c.s.
Pinachrome-violet, 1:1,000	3 c.c.s.
Orthochrome, pinaverdol, or pinachrome, 1:1,000	3 c.c.s.

Bathe for three minutes. Do not wash.

Examples show the immense superiority of a mixture of pinachrome-violet and orthochrome over pinachrome alone with exposure behind the red filter, and over a mixture of pinacyanol and orthochrome with exposure made through a green filter.—"Phot. Rund," Heft 4, 1914, p. 49. "B.J." Colour Supplement, April 3, 1914, p. 13.

Developers and Development.

Stock Developing Solutions.—G. Turner recommends the use of stock solutions of the separate chemicals as a means of time saving in making up developer employed in large quantity. In the case of the formula in general use, namely, as follows:—

1. Pyro ..	1	oz.
Metabisulphite of potash ...	½	oz.
Soda sulphite	8	ozs.
Water	80	ozs.
2 Soda carbonate ..	8	ozs.
Water	80	ozs.

a stock pyro solution is first made up consisting of 20 ozs. pyro dissolved in 80 ozs. water, with the immediate addition of 3 ozs. potassium metabisulphite dissolved in water. This makes a stock solution containing 1 oz. pyro in every 4 ozs. of the liquid. It is kept in a well-stoppered green glass bottle (Winchester quart).

For the sulphite 4 lbs. of anhydrous sulphite is dissolved in 4 gallons of water, the mixture being made in a stoneware bottle (fitted with draw off cock) in which it is kept. This stock solution is labelled

Developer No. 1.
Sulphite Stock Solution.
For use add 1 quart per Winchester.

Similarly a second 4-gallon bottle holds solution of anhydrous soda carbonate of the same strength. It is labelled

Developer No. 2.
Soda Carbonate Stock Solution.
Take 1 quart per Winchester.

Thus, in order to make up a fresh supply of developing solution all that is necessary is to measure out as follows:—

1. Pyro Stock Solution ...	4	ozs.
Sulphite Stock Solution	1	qt.
Water to fill bottle to	80	ozs.
Shake well for a few seconds.		
2. Soda Carbonate Stock Solution	1	qt.
Fill bottle and shake well to....	80	ozs.

Using a quart enamelled measure, this operation is a matter of only two minutes, whilst to renew the stock solutions only a few minutes is necessary, since the anhydrous chemicals dissolve very rapidly in hot water.—"B.J.," June 19, 1914, p. 473.

Developer for the Tropics.—J. C. Sotillo recommends the follow

ing developing formula for use in circumstances where the developing solution must be at a fairly high temperature (70° F.):—

Metol	18 grs.
Hydroquinone	36 grs.
Soda sulphite, dry	270 grs.
Soda carbonate, dry	180 grs.
Potassium bromide, saturated solution	25 drops.
Water	69 ozs.

The chemicals should be dissolved in lukewarm water, and cold water then added to make the full amount. The plates are placed in the tank, the solution poured in exactly at 70° F., slowly to avoid air bubbles, and allowed to act for fifteen minutes. Developer is then poured off and clean water poured in, after which the plates are fixed in a hardening-fixing bath, made as follows:—

Water	30 ozs.
Hypo	8 ozs.

Dissolve fully, and add the following solution:—

Water	4 ozs.
Alum	$\frac{3}{4}$ oz.
Soda sulphite	$\frac{3}{4}$ oz.
Acetic acid, No. 8	$\frac{1}{2}$ oz

After development the plates may be removed from the developer in subdued daylight without any risk of fog.

The developer itself yields a thin superficial film of hardened emulsion, whilst the use of the fixing bath given above further increases the hardness of the film to such an extent that there is no necessity to use formaline, nor to observe any special care in the temperature of the wash-waters.—"B.J.," Mar. 20, 1914, p. 213.

Under-exposed Plates.—Harold Baker recommends the following two-dish method of developing under-exposed plates. One dish contains a solution of alkali of about twice or thrice the usual strength. In this the plate is soaked for about a minute. Without washing the plate is then placed in a solution of metol and hydroquinone, *without any bromide in it at all.* The image will now begin to appear, but will remain weak and thin, however long it may remain in the second solution, but on removal to the alkali again it should acquire sufficient density; if it fails to do so it may be put into the second solution again, and in obstinate cases it may go back again into the alkali. Even when a plate has been developed in this way it may need intensification. If a trial of the first plate proves the under exposure to be so slight as to make such treatment unnecessary, it can be developed by placing in the metol and hydroquinone first and afterwards in the alkali; in such a case it should not be necessary to return the plate to the metol and hydroquinone —once in each solution should be sufficient. If the first method is adopted and the plate returned to each solution again a mixture of developer is formed in each dish, and a second plate will develop a faint image in either developer, but this is of no importance provided that the solutions are not used to a point approaching exhaustion, especially the alkali.—"B.J.," Nov. 7, 1913, p. 858.

Acid Diamidophenol.—R. E. Crowther, writing in reference to the use of the diamidophenol developer made acid with an acid sulphite, recommends the avoidance of soda bisulphite lye for this purpose, unless the acidity of the solution is known. Potassium metabisulphite possesses better "keeping" qualities, and once the best proportion of this salt has been determined no allowance need be made as the stock in the bottle diminishes. Sodium bisulphite solution, on the other hand, loses its characteristic acidity unless kept in a bottle with a well-fitting stopper. This point is, perhaps, of greater importance than would at first appear, for M. F. Monpillard has shown (Bull. Soc. Franc. Phot., 1912, pp. 289-303) that to produce the most marked "depth" effect it is necessary carefully to adjust the proportions of developer, sulphite, and bisulphite. He found that, provided free sulphurous acid be present in the developer, the higher the proportion of diamidophenol taken the more marked is the "depth" effect. Further, that increase of the proportions of sulphite and bisulphite leads to results more like those given by ordinary alkaline development.

Increase of the free acid (bisulphite) slows development enormously. A suggested developer for bromides is:—

Water	100 parts.
Soda sulphite, anhydrous	1 part.
Diamidophenol	1½ parts.
Potassium metabisulphite . . .	1-28th part (about).

The solution, prepared in the cold, must turn blue litmus paper a faint red, and, if necessary, a little more metabisulphite should be added.—"B.J.," Apr. 3, 1914, p. 273.

Depth Development.—F. Collas gives the following formula for an acid diamidophenol developer, which can be readily made up without taking anything for granted in the way of specific gravities or acidities of solutions

Water . . .	5 ozs
Potassium metabisulphite .	80 grs
Soda sulphite (anhydrous)	30 grs
Diamidophenol	23 grs

The metabisulphite should be crushed and added to the water, which should be cold, and the sulphite (which, it should be noted, is anhydrous, i.e., that sold as a powder, not crystallised) added when the metabisulphite is dissolved. Finally, the diamidophenol (or amidol) is added. As, however, the mixed solution will only keep for about a week, it is best to make a stock solution of the metabisulphite and soda, and add the diamidophenol as required. The formula is suitable for plates, films, and bromide paper. It will be noticed that no potassium bromide is given in this, neither is it required for use, as stated. The peculiarities and advantages claimed for acid diamidophenol are the remarkable transparency and delicacy of the negatives produced. Instead of commencing at the surface of the plate, as is the case with an alkaline developer, development starts in the lower layers of the emulsion, a fact which can be verified by looking at the glass side of the plate during

development; it will be seen that the image is "through" almost as soon as the solution is poured on The fog, therefore, which a plate receives on its surface, very often by reason of stray light in the camera and from other causes, is the last to receive development, not, as with other developers, the first. This superficial fog often develops up to such an extent in the ordinary way that the negative is ruined, and the more the plate is developed the thicker becomes the veiling; with acid diamidophenol the plate can be left for hours in the developing solution without fog.

It must not be supposed that contrast is unobtainable, unless one considers contrast synonymous with harsh high lights where detail is so fogged as to be unprintable. For the development of negatives which have later to be enlarged "depth development" is preferable to any other, owing to the clean negatives obtained

This developer, made up according to the formula given above, is fairly rapid in action, an average time for the development of a plate being about three minutes at a temperature of 60° F—"A.P.," Jan. 12, 1914, p. 28.

Dark-Room Blindness.—L. T. Woods recommends the use of bright yellow light instead of white light in the dark-room when illumination is necessary after working by a deep safelight and before returning again to such very dim illumination. By this plan the semi-blindness, which is experienced when returning to the deep green light, such as is used for panchromatic plates, is of much shorter duration.—"B J," May 29, 1914, p 430.

Metol Poisoning.—Various remedies or preventives of the skin affection resulting from the use of metol as a developer have been suggested. J. Middleton recommends, as a complete cure, dressing the fingers every night, after developing, with "Almora," a preparation made by the Almora Company, 41, George Street, Croydon.

P. R. S. has found the "Hazeline" cream of Burroughs Wellcome a complete cure.—"B.J.," Apr. 17, 1914, p. 312.

E. J. Davison has found that Resinol salve, sold by the Resinol Chemical Company, New Oxford Street, London, W.C., is a cure for metol skin affection.—"B.J.," May 15, 1914, p. 389.

A. Bennett recommends the following as a cure:—Dissolve one pennyworth sugar of lead in 10 ozs. water, and wrap the affected part in clean rag soaked in this solution, keeping the bandage on all night, and repeating soaking in the solution as the bandage dries.

J. Brushwood recommends to users of the metol developer for "Cyko" paper a formula containing carbonate of potash in place of soda carbonate. This difference (as noted in "B.J.A.," 1914, p 625) has the effect in some cases of avoiding the injurious effects of metol. The formula is :—

Water	40	ozs.
Metol	90	grs.
Soda sulphite (crystals)	3½	ozs.
Hydroquinone	130	grs.
Potassium carbonate (pure)	1½	ozs.
Bromide of potassium	220	grs.

This developer is double strength; for use, take one part water and one part developer.—"B.J.," May 29, 1914, p. 431.

Alva May gives the following lotion for use in cases of skin poisoning by metol:—

Acetic acid No. 8	1 oz.
Water	2 ozs.
Sodium chloride, common salt	1 tablespoonful

Use this four or five times a day for several minutes at a time, rubbing it well into the skin.—"Cam. Craft," Jan., 1914, p. 30.

E. A. Freeman recommends the following procedure, which has been found an effective preventive of metol sores in regular work:—On a lighted gas-ring place a bowl containing a quart of cold water; add to this two drops of pure carbolic acid. Immerse the hands until the heat becomes too great, then wash thoroughly with carbolic soap and dry well. If this is followed each evening after development, metol sores will trouble no more. Average cost, 1d. per week.—"B.J.," June 5, 1914, p. 445.

Another remedy for metol poisoning is that recommended by C. R. Lowe, namely, permanganate of potash rubbed into the skin, followed up by cleaning with oxalic acid, as for the removal of pyro stains from the fingers.—"B.J.," Sept. 11, 1914, p. 693.

Rapid Negative Making.—A. E. Bawtree, in an article on the use of the Wratten fine grain Special Process plate, issued as of speed 1½ Watkins, lays stress on the speed with which a negative can be finished off after exposure as a consequence of the very thin film on the plate. As regards its properties and speed, the plate is very similar to that of the wet-collodion process, and is almost its equal as regards the time within which a finished negative can be made, which is about 17 minutes from the moment of commencing development to the completion of the dried negative and including intensification

The only point needing special attention is not to work at too low a temperature if quick results are required. The various solutions work best at about 70° F.

Development—in Wratten Process Hydroquinone developer for two minutes, followed by a thirty seconds' rinse.

Fixing, in Wratten Acid fixer for about the same time as development. Wash for thirty seconds under the tap, and then for a couple of minutes in four changes of water coloured pink with a few drops of a 5 per cent. solution of potassium permanganate.

Intensify by bleaching in

Bichloride of mercury	60 grs.
Potassium bromide	60 grs.
Water	5 ozs.

Blackening is performed in a 5 per cent. solution of sodium sulphite. A mere rinse under the tap may be given between bleaching and blackening, but is hardly necessary, as the two solutions have no reaction upon one another.

After a thirty seconds' wash under the tap the plate is placed upon a whirler and surface moisture thus removed. While on the whirler it is flowed over twice with methylated spirits, whirled again, detached, the back wiped, and it is finally waved gently in front of a fire or radiant gas stove. Drying in this manner takes no more than three minutes.—"B.J.," Apr. 24, 1914, p. 320.

Hydroquinone Substitution Compounds.—A. and L. Lumière and A. Seyewetz, from experiments on compounds differing from hydroquinone in that one or more atoms of hydrogen are replaced by chlorine or bromine, have formed the following conclusions in respect to the developing powers of the new compounds :—

(1) Compounds in which substitution of a halogen (chlorine, bromine, etc.) has been made in the hydroquinone nucleus tend to possess greater developing power. Bromine is more active in this respect than chlorine.

(2) The sulphonic acid group, as also the nitro group, considerably reduces the developing power of hydroquinone. In the case of the compound containing two nitro groups the developing power is entirely absent.

(3) A halogen group introduced along with one of sulphonic acid weakens the retarding effect of the sulphonic group, and does so in the various cases of different relative positions of these two groups

(4) The substitution of a methyl group very considerably increases the developing power of hydroquinone.—"B.J.," May 1, 1914, p 341.

New Glycin Developers.—The Actiengesellschaft für Anilin Fabrikation have patented new photographic developers, the basis of which is an oxy-phenyl-alkyl-glycin compound. Two examples of the method of preparing the developing substance are as follows :—

1. 246 parts of 4-methylaminophenol, 110 parts of chloracetic acid, and 1,000 parts of water are boiled together for 3-4 hours. From the cooled solution the 4-oxyphenylmethylglycine separates. It is recrystallised from boiling water. The compound is very soluble in alcohol, warm glacial acetic acid and hot water, but difficultly soluble in benzine and chloroform, insoluble in ether, acetone, and ligroin.

2. One part of 4-oxyphenylmethylglycine is dissolved with five parts of crystallised sodium sulphite, and five parts of potassium carbonate in twelve parts of water. This solution is a concentrated developer which is to be diluted for use with 10-30 parts of water.—Eng. Pat. No. 18,095, 1913; "B.J.," May 29, 1914, p. 423.

Combined Development and Fixing.—C. Otsuki and T. Sudzuki have tested the combined developing and fixing solution proposed by Cremier ("B.J.A.," 1911, p. 549), containing 1 gm. of amidol and 2.5 gms. of thiosulphate in 100 c.c.s. of water, and find that it does not give images of sufficient density, and requires from thirty-seven to forty minutes to act completely. The authors tried to prepare an amidol solution which would work more rapidly, by increasing the amounts of amidol and thiosulphate, but the images were still too thin. Similarly with metoquinone and sodium sul-

phite and carbonate, it was impossible to obtain sufficient density. However, it was found that the use of caustic soda instead of carbonate resulted in a rapidly acting solution which gave satisfactory images The best formula is · Metoquinone, 0.6 gm.; anhydrous sodium sulphite, 3 gms.; caustic soda, 0.5 gm.; sodium thiosulphate, 6 gms.; water, 100 c.c.s. In this solution the image is completely developed in sixty to ninety seconds at a temperature of 18 deg. to 22 deg C. It is best to make the metoquinone and sulphite into one solution and the caustic soda and thiosulphate into another, and to mix the two at the time of using.—"Phot. Korr.," May, 1914, p. 214; "B.J.," July 10, 1914, p. 541.

Fixing.

A Hardening-Fixing Bath.—G. Smee recommends the following formula for the fixing bath which can be used regularly at as high a temperature as 75 or 80° F., and is without any detrimental effect upon the delicate tones in the negative.—

Water (warm) .	64 ozs.
Sulphate of magnesia (Epsom salts)	4 ozs.
Hyposulphite of soda	20 ozs

It is not necessary for the water to be hot, and the mixing may take place either in a large glass bottle or in a stoneware pitcher.

When the sulphate of magnesia and hyposulphite of soda are dissolved, the liquid should be strained through muslin, owing to the presence of both chips and dirt, which must always be kept out of this fixing liquid, so as to aid in securing the best results.—"Wilson's," May, 1914, p 227; "B.J.," June 26, 1914, p. 499.

Testing Fixing Baths.—A. Bilty has patented a material for indicating when prints are completely fixed. It consists of paper of strong colour, or with a pattern or other design printed on it. It is coated with emulsion, similar to that employed for the printing paper. On placing a test strip of this special paper in the fixing bath along with the print the design or pattern of the paper shows up on the emulsion coating being dissolved away by the hypo. If this does not take place it is a sign that the fixing bath is exhausted.—Eng. Pat. No. 9,691, 1913; "B.J.," Dec. 5, 1913, p. 939.

Rapid Fixing Baths.—C. Welborne Piper has carried out a number of measurements, investigating the extra rapidity of fixing action obtained by adding ammonium chloride to the hypo bath. The measurements were made with small strips of emulsion-coated celluloid film, the time required for the white emulsion coating to disappear being noted. In the case of a 40 per cent. hypo bath, fixing in 2¾ minutes, it was found that addition of 1¼ per cent. ammonium chloride reduced the time of fixing to 2 minutes, but further additions of ammonium chloride gradually increased it up to 15½ minutes, the time with 20 per cent. ammonium chloride. The accelerating effect, therefore, with a hypo bath of this strength is negligible.

With a hypo bath of 10 per cent. strength (fixing in 12½ minutes)

addition of 5 per cent. ammonium chloride reduced the time of fixing to $3\frac{1}{4}$ minutes. It was found that the best average result as regards time of fixing was obtained with a 20 per cent. hypo bath containing from $2\frac{1}{2}$ to 5 per cent. ammonium chloride, in which bath the time of fixing was 2 minutes.—"B.J.," March 13, 1914, p. 193.

Ammonia is found, in minute proportion, to accelerate the action of a weak hypo bath, but to retard a strong bath containing over 50 per cent of hypo. But if sufficient ammonia be added all hypo baths are accelerated, although more ammonia than is permissible is necessary for the most enhanced degrees of acceleration. The quickest bath which could be used in practice is one containing 30 per cent. of hypo with 5 per cent. of ammonia 0.880.

Mr Piper lays stress upon the fog which may be produced upon a plate solely as the result of the fixing bath. A very strong bath—say, 60 per cent., used at normal temperatures—not only fixes slowly but fixes imperfectly, leaving a slight deposit on the film, which is not removed by any prolongation of the time of fixing. Other tests have shown that a very similar type of fixing fog is also caused by fixing in actinic light, even when using a fixing bath of normal strength.—"B.J.," June 5, 1914, p. 437.

In examining the fixing effect, as regards speed, of sulphocyanide, Mr. Piper finds that the quickest rate is shown by ammonium sulphocyanide, which in 35 per cent. solution requires only 15 seconds. It is, however, doubtful whether sulphocyanides are of any practical use owing to their softening action upon gelatine In admixture with hypo, ammonium sulphocyanide yields a very quick-acting bath. Taking $2\frac{1}{2}$ per cent. of sulphocyanide as the safest proportion to use, the following formula will give the most rapid bath possible :—

Hypo	6 ozs.
Ammonium sulphocyanide .	$\frac{1}{2}$ oz.
Water to	20 ozs.

This bath will fix in just two-thirds the time of 40 per cent. hypo, which is the most rapid plain hypo bath that can be used.

Photographers are often advised that fixing is not complete when the visible bromide has disappeared, but they often neglect this advice because no visible difference is observable, at any rate for a long time. The time of disappearance of the bromide is the first stage of fixing that has formed the subject of the experiments, and the determination of the second stage at which fixing is really complete is not easily effected with hypo. Twice the time of the first stage is, however, probably sufficient. With sulphocyanide fixers the second stage can be in a way determined, because incomplete fixing is shown very rapidly by a deposit that forms in the washing water. Anyone who doubts the necessity of prolonging the time of fixing will soon be convinced if he tries a few experiments with ammonium sulphocyanide. Putting a plate into, say, 30 per cent. sulphocyanide, it will very rapidly clear, but if the moment it is clear it is taken out of the fixer and held under the tap, it will become opaque all over owing to the precipitation of some silver compound. A second dip in the fixer will clear the plate again,

but if this dip is not long enough the deposit will reappear in a less dense form when the tap water is again applied. If fixed long enough the effect will not occur at all. This experiment makes it evident that the mere clearing of the film does not denote the removal of all silver compounds, and it emphasises the necessity of prolonged fixing in a way that no one can mistake.—"B.J.," June 12, 1914, p. 458.

Deferred Fixation.—J. E. C. gives a method of treatment for plates when developing soon after exposure, but postponing fixing until a later time. He does not advocate such deferred fixation, but recommends it only on the ground that it is much better to adopt this plan than to fix a negative and to defer a thorough washing until later. After development, rinse the negative for a moment, place it for one minute in weak hydrochloric acid, say one part of acid to 40 of water, and then wash it for a few minutes. The negative, when dry, may be exposed to daylight, and will be found gradually to darken. This darkening, if it went far enough, would no doubt ruin it, but two or three hours in diffused light seem to have no permanent effect. The creamy yellow darkens to a greyish violet, it is true, but this vanishes, or all but vanishes, when the negative is subsequently fixed.—"Phot.," Dec. 9, 1913, p. 479.

Stain Removers.

Removing Stains.—J. M. Sellors, in a paper before the Croydon Camera Club, strongly recommended a method of removing stains due to developers, etc., from negatives, originated by R. E. Blake Smith. The image is first bleached in an acidified bichromate bath, the original formula being: Bichromate of potash, 65 grs.; sulphuric acid, 400 minims; salt, 1 oz.; water, 10 ozs. Personally he preferred and used the Piper and Carnegie bleacher in proportions recommended to obtain an average amount of intensification, as follows:—Bichromate of potash, 10 grs.; hydrochloric acid, 5 minims; water, 1 oz. After bleaching, the plate is washed for about 15 to 20 minutes to remove yellow stain, and the following solution flowed over:—Permanganate of potash, 6 grs.; sulphuric acid, 30 minims; water, 5 ozs. A few minutes will usually remove slight stains (for obstinate ones a longer immersion is requisite); but the plate should not remain in the solution for more than 20 minutes, or the image may be attacked. After removal it is placed for a short time in either (a) sodium sulphite, 6 grs.; sulphuric acid, 8 minims; water, 3 ozs.; or (b) a one in ten solution of sodium bisulphite-lye, which will remove the residual tint given by the permanganate. Mr. Sellors employed the latter as being simpler. The plate is next washed for ten minutes and re-developed, preferably with amidol. The process does not perceptibly affect the gradation of the negative, as might be thought, or alter its printing value.—"B.J.," May 8, 1914, p. 369.

A Powerful Stain Remover.—R. E. Blake Smith recommends as the best method for removing almost all descriptions of stain from

the negative the permanganate bleaching and re-development process given under "Bleaching Sulphide-Toned Prints" in Section V. In making the bleaching bath, however, the quantity of A solution should be doubled.

For the removal of dichroic fog an efficient method is as follows.— Take a small quantity of the well-known bichromate-chloride bleacher—

Potassium bichromate ...	35 grs.
Sodium chloride ...	½ oz.
Concentrated sulphuric acid	200 minims
Water ...	5 ozs.

and dilute it with from five times to ten times its volume of water The plate, after being well soaked in water, is immersed in this solution till the stain is bleached to silver chloride The very finely grained silver forming the dichroic fog is readily acted upon by the dilute bleaching solution and entirely converted into silver chloride before any appreciable action takes place on the metal of the image. The plate is then washed, fixed, and washed again - "B J," June 26, 1914, p. 492

Removing Drying Marks from Negatives.—O. E. Challis states that he has cured several negatives that had been splashed and afterwards dried, leaving a spot of different density, by bleaching in an ordinary ferricyanide and bromide bleaching bath, and then re-developing with amidol. This method ought to be quite satisfactory for negatives that have had rain spots on them, at any rate it does not damage the negative in any way.—"B J," Jan 23, 1914. p 74.

Reduction.

Cobaltamine Reducer—Harry E. Smith has published full details for compounding this reducer, which, in its action on the tones of the negative, resembles ammonium persulphate, but is free from the irregularity which is at times experienced in the use of persulphate.

The reducer consists of one part of Erdman's potassium salt and nine parts of the trio sodio cobaltic nitrite. This latter salt is listed in one or two of the best chemical lists, and can be bought, as it is used in analysis for precipitating potassium. As, however, it is usually sold in solution full particulars are given for its preparation in the pure crystalline powder form necessary for making a reducer, and also practical directions for the production of the Erdman's salt.

There is more than one way of making Erdman's potassium salt, but none of the variations are capable of giving a good yield. The following is the process recommended:—

1. 100 gms. of cobalt chloride ($Co\ Cl_2$) are dissolved in 3 ozs. or 85 c.c.s. of water. The solution is boiled and allowed to cool.

2. 150 gms. of ammonium chloride ($NH_4\ Cl$) are dissolved in 16 ozs or 450 c.c.s. of *cold* water.

3 150 gms. of potassium nitrite (KNO_2) are dissolved in 4 ozs or 114 c.c.s. of warm water, the solution filtered and allowed to cool.

Add No. 2 to No. 1 and then add No. 3, all being quite cold, and leave overnight. As nitrous fumes are given off it is well to leave the dish or flask out of doors, covered by a box. In the morning wash away with cold water the greenish precipitate from the reddish-brown crystals of Erdman's salt. The precipitated mixture may be shaken up with successive portions of cold water, and as each addition is carefully poured off, the greenish precipitate is easily separated from the heavier crystals of Erdman's salt, which quickly settle.

Indeed, water may be run straight from the tap into a dish containing the precipitated mixture. The flow of water and careful stirring will soon clear the light precipitate from the heavier crystals with very little loss of the latter. The Erdman's crystals, unless finely powdered, are only slowly soluble in cold water. After separation, the Erdman's salt should be re-crystallised from hot—not boiling—water. The yield from the above quantities should be 32 gms.

This salt is soluble in about fifty parts of water, but not more than half this quantity (say 800 c.c.s. or 28 ozs.) is necessary for the re-crystallisation of the above 32 gms., for if the salt is thrown on a filter (preferably in a hot water jacket) it crystallises out as the solution runs into the receiving dish and cools, and the solution may be warmed up short of boiling and poured through the filter again and again.

The salt can be drained on filter or blotting paper, and when dry will keep for years unaltered in an ordinary stoppered bottle.

To make the tri sodio cobaltic nitrite:—

1. Dissolve 900 gms. of sodium nitrite ($Na\ NO_2$) in 900 c.c.s. of water by warming in a 3-litre Jena glass flask.

2. Cool the flask under the tap until the solution is 50° C. or 122° F.

3. Add to the cooled solution 300 gms. of powdered crystallised cobalt nitrate [$Co\ (NO_3)_2$], and as soon as dissolved

4. Add 300 c.c.s. of 50 per cent. acetic acid (*i.e.*, 150 c.c.s. glacial acetic acid mixed with 150 c.c.s. water).

The action on addition of the acid is apt to be vigorous, and nitrous fumes are freely evolved. The flask must be held under the tap to keep the temperature down and the liquid from frothing over. The acetic acid must be added in small quantities at a time or the reaction will get out of hand.

5. After the last of the acid has been poured in shake the contents of the flask and allow to stand for half an hour.

6. Filter off the potassium salt, which is nearly always precipitated. This is best done slowly through a Buchner funnel with the aid of a filter-pump fixed to the tap.

7. Aspirate a current of air through the filtered liquid for one hour in order to remove the oxides of nitrogen. The cheap glass type of filter-pump so easily fixed to a tap is excellent for this work.

8. Add to the aspirated filtrate 900 c.c.s. of alcohol, shake round, allow to stand for half an hour, and then filter on the Buchner funnel with the aid of the filter-pump. When the mother-liquor has been sucked through by the filter-pump two small quantities of alcohol may be run through the precipitate in the funnel. The second should come through almost white.

9. Suck through as much of the last washings of alcohol as possible by means of the filter-pump, and then place the damp crystalline precipitate in a vacuum evaporating apparatus heated by a water bath. The filter-pump again comes in for this work, and the alcohol is easily removed, leaving the tri sodio cobaltic nitrite as a dry orange-yellow crystalline powder.

The yield for the above quantities should be 360 gms.

To make the reducer, powder one part by weight of the Erdman's salt in a mortar, add nine parts of the dry tri sodio cobaltic nitrite, and with the pestle produce an intimate mechanical mixture of the two compounds by trituration. The best way is to remove the Erdman's salt from the mortar when powdered, put in the nine parts of the tri sodio salt, and then add the powdered Erdman's salt in small portions to the greater bulk while triturating.

This mixture may be bottled off for use. It keeps well.

The mixed cobaltamine powder, as above, is rendered active for reducing purposes by the addition of nitric acid. The solution is made as follows:—Four grains of the powder are dissolved in two ounces of water, and thirty drops (or half a drachm) of nitric acid are added.

The dish should be rocked during reduction, in order to keep moving the slight precipitate of Erdman's silver salt, which seems to form on the surface of the negative.

When the dense portions have been sufficiently reduced, rinse the negative well under the tap for a minute or two, and then place it in a bath of dilute ammonia 3 per cent. strength (*i.e.*, three parts by measure of 0·880 ammonia in one hundred parts of water). The negative should be left for three minutes in the ammonia bath, and finally washed for about twenty minutes in running water.

From five to eight minutes' reduction is usually sufficient, but in cases where development has been carried so far that the sky shows no clouds at all, though they should be there, it is well to rinse the negative under the tap, and place it in a fresh reducing bath for another five minutes. This may, indeed, be done several times before the action of the shadow-detail is very noticeable, while the reduction of the sky and dense portions of the negative becomes all that can be desired.

Old negatives should be well soaked in water before starting to reduce them. After the final wash, the reduced negative may well be wiped gently with a tuft of wet cotton-wool before being set up to dry.—"B.J.," January 2, 1914, p. 5

To Gauge Progress of Reduction.—An aid to judging of the extent to which a negative is being reduced while lying in the reducing bath is to place underneath the negative (in the dish) a piece of paper printed with very clear type. It is found that by looking at the type through the plate it is much easier to decide when to stop the action of the reducer.—"Phot.," Jan. 20, 1914.

Stripping.

Stripping and Reversing Gelatine Negatives.—R. B. Fishenden gives the following working details of the method worked out by himself:—

The negative to be stripped is first cut close round the four edges with a sharp knife; in the operation of coating the glass with emulsion the edges are liable to be covered, so that the film may become torn in lifting it from the glass if the above precaution be not taken The plate is then immersed in a solution of formalin (40 per cent. formaldehyde) for ten minutes to harden the film completely, and afterwards transferred to another bath of formalin containing a small proportion of fluoric acid—not more than 2 per cent. —and allowed to remain for twenty seconds. The plate is removed from the solution, washed under the tap, and the narrow strips of gelatine round the edges which were cut free are removed from the

The washing is continued for sufficient time to remove any free acid; there is no danger of the film crinkling or lifting from the glass unless the soaking in the acid and formalin bath has been too prolonged.

A piece of hard-sized writing paper slightly larger than the negative is soaked in water, and the negative to be stripped is laid with the film uppermost on a white board. The paper is squeegeed in contact with the film and a corner of it lifted; a pointed knife is then slipped under a corner of the film, and the film and paper are gently pulled away from the glass, the paper acting as a support for the gelatine film. The use of the paper as a support is an advantage over the ordinary method, wherein the film is floated off the original glass and floated on to another one.

The film being supported on the wet paper, the next operation will depend on whether the negative is merely to be removed to another glass or requires reversing. In the first case the new glass is cleaned, and, whilst wet, it is laid upon a level board which has been covered with a sheet of paper or a piece of rubber sheeting. Over the glass is poured the following solution, which should previously have been filtered:—

Gum arabic	2 parts
Glycerine	1 part
Water	20 parts

The film on the wet paper is brought into contact with the glass, one edge being carefully lowered on to the coating of solution, and carefully and firmly is laid down so as to expel air-bubbles in the operation. The back of the paper is gently squeegeed and the paper lifted slowly in order to see whether the film is correctly placed on the glass; if not, it can be easily adjusted. The paper is again laid on the film and the squeegeeing repeated. Now remove the paper and examine the film, which should be found to be correctly placed and free from any bubbles. Hard squeegeeing must be avoided, because it is liable to distort the film. The plate is dried in a current of air on a level slab. It may be placed on edge when the earlier stages of the drying are over, as by this time the film will have become attached to the glass, so that there will be no danger of its becoming displaced.

In the preparation of a reversed negative the operations are similar to the above up to the stage of lifting the film from the original glass on to the wet paper; a second piece of wet paper is then laid on the

first in contact with the film, and the first paper lifted away, leaving the film reversed on the second paper. The remainder of the operations are carried out as described above.

There are a few precautions necessary in order to ensure that the process of stripping a gelatine negative may be successfully accomplished. The negative must not be varnished or have any spots of grease upon it. Varnished negatives must be cleaned with alcohol or benzine, depending on the solubility of the varnish. Grease spots must be removed with benzine. Retouched negatives will strip without any difficulty, provided that the medium has not been applied too freely, which may prevent the ready penetration of the fluoric acid. It is well to practise with a few waste negatives before stripping a valuable one in order that facility in the operation may be acquired. Glass measures must not be used, and the quantity of acid may be roughly estimated; within certain limits the proportion of fluoric acid used with the formalin is not a matter of great importance, and preliminary trials on waste negatives will show how long soaking in the formalin and acid bath is necessary, which may be slightly less or more than the twenty seconds specified. Any description of dishes may be used, excepting those of porcelain or glass. Formalin has a pungent odour which is liable to attack the nasal passages, so that it is well to keep the dishes covered. Formalin decomposes on exposure to light, and therefore should be kept in the dark-room.

The gum and glycerine solution is for the purpose of attaching the film to the glass. The formalin completely insolubilises the gelatine film, which is liable to peel away from the glass after a time if this solution is not used. The gum is an adhesive, and the glycerine, being hygroscopic, causes the film to retain a slight amount of moisture, thus counteracting the abnormal dryness induced by the formalin. An alternative method of working is to soak the negative in a 2 per cent. glycerine bath for five minutes after the washing to remove the fluoric acid; then the film is lifted from the glass, which retains a slight trace of glycerine. If this procedure is adopted a plain solution of gum of the same strength is used instead of the glycerine and gum solution, when the film is finally mounted on the glass plate.

The advantages of the method described are obvious, and it does not entail any difficult operations. Any of the usual methods of stripping with fluoric acid cause the film to stretch to some extent, the amount depending on the process followed and the degree of washing to remove the acid. A bath of methylated spirit is often suggested to counteract this tendency, but may cause an actual shrinkage of the film from its original size. Distortion is also caused by the ordinary processes, because the gelatine film is in such a flaccid condition. The writer finds that by the modifications he suggests such disadvantages are avoided, whole-plate negatives frequently being stripped, reversed, and replaced on the original glasses without any variation in the dimensions. The removal of the acid in the film leaves the gelatine in an inert condition, which cannot be done in the usual methods.

For certain purposes the unsupported film of the gelatine negative may be required. This may be secured by adopting the process described, mounting the film on a piece of talced glass, and omitting the use of the glycerine and gum. When the film has dried it may readily be peeled off the glass. The film may alternatively be mounted on celluloid, which should be pinned to the rubber sheeting during the operation of mounting. The adhesive must be used in this case, as when mounting on a glass plate.—"B.J.," Dec. 26, 1913, p. 995.

Retouching.

Blocking-out Negatives.—W. Ethelbert Henry gives the following hint on blocking-out backgrounds in negatives, where the difficulty is met with of the opaque drying quickly and clogging the pen:—' The correct way is to stir the opaque thoroughly, and then feed it to the pen with a camel-hair pencil, putting only a little on the nib and wiping over the point with the camel-hair pencil each time it is used to apply the opaque. If the pen is simply dipped in the bottle of pigment failure is certain. It is preferable to do all outlining with a well-pointed, fair-sized hair pencil (not a tiny spotting pencil); it is far the best way and easily acquired.—"B.J.," Dec. 5, 1913, p. 943.

V.—PRINTING PROCESSES.

Positive Portraits Direct.—W. Ricketts recommends the following developing formula for use with ordinary plates of speed up to about 30 H. and D. for positives direct in the camera:—

Hydroquinone	300 grs.
Metol	30 grs.
Carbonate of soda	2 ozs
Sulphite of soda	2 ozs
Bromide of potassium	40 grs.
Water	20 ozs.

Put the two sodas into a dry bottle, add the hydroquinone, shake well, pour in one pint of water, and shake until dissolved Dissolve the metol in half a cup of warm water, pour it into the bottle, add the bromide, and shake well.

This developer is now fit for use for ordinary dry plate work, and can be used over and over again for plates and papers.

For positives direct:—

Hypo	6 ozs.
Ammonia liq. ·880	1 oz.

Put the hypo into a dry bottle, pour in the developer, and shake well until dissolved, then add the ammonia Keep well corked, and the developer will keep good for some years.

Ordinary dry plates may be converted into positives direct by using this developer. The plates most useful for this process are the thinly coated slow plates, speed 16 up to 80 H.D.; Imperial fine grain, speed 30 to 40 H.D., were found to give the best results; Paget, Wellington, Barnet, etc., fast lantern plates are very good The slow variety are much too slow for exposure in the camera The veriest novice can get good results. All that is needed is something near the correct exposure. Leave the plate in the developer about one minute; in cold weather a little longer development is required. The result is not a lantern slide, but a negative with the deposit whitened, therefore it requires a piece of black paper, velvet, or black varnish to show the image. If the deposit is not deep enough, add to the developer in the dish a little more ammonia or give a longer exposure. If nothing but a white smudge with no contrast, add a little more hypo or give less exposure; no separate fixing is necessary, developing and fixing both going on at the same time in the one bath. Wash well for a few minutes. Almost any formula will do with the addition of hypo 6 ozs. and ammonia 1 oz to the pint, and a little extra bromide.—"B J.," May 15, 1914, p. 390.

Postcard Portraits Direct in the Camera.—W. Ricketts describes the following method used by himself for while-you-wait photography :—

First take an ordinary gaslight card and expose it to the light, giving only the correct exposure required to obtain a good black by development. After exposure coat the card on the gelatine side with collodion emulsion. It can be exposed in the camera directly it is coated if desired, or can be stored for a few days. It is usual to put a card or plate coated with collodion emulsion through an organifier to fill up the small pores in the emulsion. The under coating of gelatine seems to do all that is necessary in that respect. After exposure in the camera develop in the developer given below, keeping it as cool as possible. A double dish with a little fresh hypo in the under dish will do. After developing and fixing rinse the card in clean water, then soak for a few moments in methylated spirit, place the card on a firm surface, and rub away all the collodion, and underneath will be found a positive just as if taken from a negative.

Thus it is a negative positive process. The reason for this result is quite simple. Directly the card is in the developer, where the light has acted on the emulsion a deposit begins to form, preventing the developer from penetrating through to the under emulsion, which was exposed before putting on the second coating. Where the light has not acted the developer penetrates and develops the gelatine emulsion, so that by one development we get the negative and positive. If the correct exposure was given to the gaslight card the positive will be all that can be desired. If under-exposed the image will be faint; if over-exposed a poor yellowy green will be the result, which, however, may be remedied by toning in a sulphacyanide and gold toning bath, or be converted to a nice sepia by the ferricyanide

and sulphide toning. After a little practice this will not be necessary.

Collodion emulsion can be obtained from Messrs. Penrose and Co., 109, Farringdon Road, London. Dr. Albert's "Eos Emulsion" without the colour sensitiser is suitable. This costs in small quantities about 1s. 6d. per oz., and is supplied in 5, 10, and 20-oz. bottles. One ounce when diluted with 3 drachms methylated ether will coat about forty to fifty postcards, providing one's fingers are not all thumbs. The best way to coat is to use an old postcard printing frame; cut a gutter in the right hand bottom corner, so that the emulsion will run back into the bottle. First put in the card, then an old negative, put in the back, and fasten it Now hold the frame on the tips of the thumbs and fingers, pour a small pool in the middle, float to the right-hand corner, then to the top left, then to the bottom left, then to the bottom right corner, running the surplus back into the bottle. The collodion will set almost as soon as coated. It is very quickly done with a little practice It can be exposed immediately it is coated. It is important that card, not paper, be used, as with paper the developer penetrates through and spoils the effect.

Formula for Development.

Hydroquinone	¾ oz.
Soda carbonate	4 ozs.
Soda sulphite	2 ozs
Potassium bromide	40 grs.
Water	20 ozs.

Mix in a 30 oz. bottle, single solution.

This is the old formula for ferrotype positives, and yields the best results of any tried.

If Dr. Albert's Eos Emulsion is coated on ferrotype plate, put through an organifier, dried and developed in the above developer, it will yield a perfect tintype positive. Points to be remembered are :—First, card only must be used; second, correct exposure is necessary; third, developer should be kept cool. If these points are watched good results should be obtained.—"B.J.," June 5, 1914, p. 446.

Positives by Reversal on Dry-Plates.—A. E. Bawtree, in an article on the special process plates of Messrs. Wratten, points out the effective way in which they can be used for the production of positives direct, allowing, for example, of line subjects being prepared as lantern-slides without the intervention of a negative. The process is as follows :—

The plate is developed in the ordinary way with the Wratten developer. It is then rinsed well under the tap and whirled surface dry. Next it is placed, face outwards, in an ordinary printing frame without a glass front, the back covered with black paper, the frame stood up on edge, and an exposure given of 6 ins. of magnesium ribbon at a distance of one foot, or for large negatives 2 ft. of ribbon at 2 ft. distance.

The first developed image is now dissolved away in

Potassium bichromate	1 oz.
Water	40 ozs.
Nitric acid	½ oz.

The effect must be judged by watching the disappearance of the dark image on the glass side of the plate, as there is very little change on the film side. The image is thrown out in the form of a dark precipitate, which must be next removed by fairly vigorous wiping under the tap with cotton wool.

The plate is redeveloped in

Water	20 ozs.
Sulphate of soda	1 oz.
Amidol	50 grs.
Potassium bromide, 10 per cent. sol.	½ oz.

Development is slow, occupying about four minutes at 70° F. It is stopped as soon as the white background appears to begin to veil over. This veiling is due to the fact that the first development did not reduce all the salt that had been acted upon by light during the original camera exposure

Finally, the plate is fixed and, if necessary, intensified with mercuric bromide followed by soda sulphite.

The above instructions are for process positives. For continuous tone results the Wratten developer is too vigorous, and the above amidol developer must be used for the first development, but, unlike the Lumière Quinomet developer, a fresh supply must be employed for the second development. Development must be stopped as soon as the deepest shadows commence to veil over This leaves much exposed but unreduced silver salt for the second development, causing a fair amount of fog. Being independent of the evenness of coating of the plate, this fog is not only no disadvantage, but a positive gain. The plate tends to give too vigorous a positive, and the fog tones this down very evenly. If a clean positive is needed, as for projection purposes, the plate can be cleared in the ordinary way with ferricyanide, used very dilute —" B.J.," Apr. 24, 1914, p. 320.

Albumenised Paper.

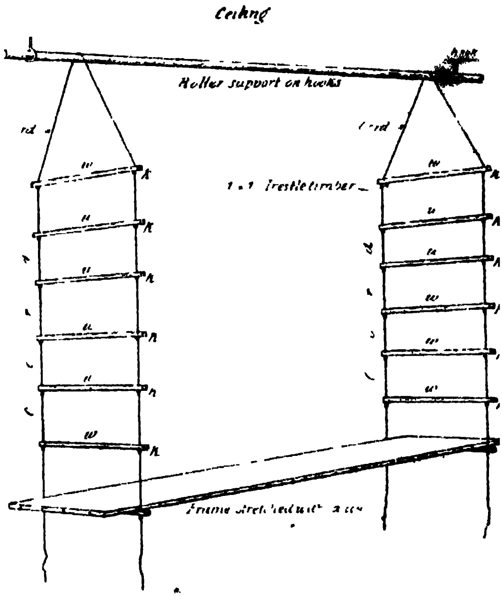
Preservative for Albumenised Paper.—G. T. Harris recommends for the preservation of sensitive albumenised paper a bath of soda sulphite and sodium bisulphite. He sensitises the paper about a quire at a time, floating it on a 60-grain neutral bath When surface dry, but whilst still damp and flexible, the paper is re-floated on the back on the following solution :—

Sodium sulphite	5000 grs.
Sodium bisulphite (crystals)	1000 grs.
Water	100 ozs

The sheets are then fully dried, placed face to face, and rolled round a wooden roller until a firm, compact roll is established. In this state the paper will keep perfectly white and fresh for weeks. No unfavourable action in toning results from the use of the preservative, as so often is the case when citric acid is used. —" B.J.," Mar. 20, 1914, p. 215.

Drying Prints.

A Print-drying Rack.—A useful device for drying prints in quantities and, at the same time, capable of being quickly dismantled and packed away within a small space, is described as follows by a contributor to the "B.J.":—A good size is about 27 ins. x 54 ins., as this accommodates eleven postcard strips, six on each strip, or fifteen 10-in. x 8-in. enlargements. Having decided upon the size and number of tiers, a frame of light wood, or, better still, of 1-in. picture moulding, is made for each tier, and all of a uniform size.



Having done this, the next thing is to purchase some fine, thin calico (which has been found to serve excellently) of the right width and quantity. Having cut the cloth a matter of 1 in. larger all round than the frame, and strengthening the edges by stitching them, they are conveniently fixed on to the frames with drawing pins all round the margins at intervals of 3 ins. or 4 ins., thus allowing the sheets to be quickly put on or taken off when required to be washed—which should be regularly.

The frames and sheets now being completed, we secure into the ceiling (or into a beam) two large screw-hooks at a distance a little less apart than the length of the size of the frames. These hooks

support a length of wooden roller of sufficient stoutness to carry a little more strain than is likely to be put upon it. Now take two pieces of wood about 1 in. x 1 in. and perhaps 5 ins. longer than the width of the frames, for each tier. At a distance of 1 in. from each end of these pieces of timber drill a hole large enough to pass the necessary length of cord, upon which the racks are suspended.

This being done, a piece of cord is taken, and the centre found by doubling it. One of the pieces of wood is now taken and each end of the cord passed through each hole. Having decided at what distance you require the top rack to be from the hooks above, tie a knot on the underside of the wood at each end. The other pieces must have the cords put through and the knots tied at the distance you require the tiers to be apart. It must not be forgotten that if placed too far apart there is a loss of space; if too close, ventilation is insufficient, and, consequently, drying is slow. A distance of from 7 ins. to 8 ins. is satisfactory.

The manner of further fitting up will be understood from the sketch. Care should be taken to tie all the cords at a uniform distance to ensure the tiers being level; the roller is to be movable; the cords may then be slung over. The whole thing can be dismantled and the frames stacked away in a clean place in a moment. The best way to put out the prints is to have previously sponged them and squeegeed out as much superfluous water as possible. They are then carried on a sheet of plate-glass to the rack, and having placed one of the frames across the bottom "trestle," commence laying the prints face down.

It is the only convenient way to have each stretcher in place ready and to work from bottom to top. When the work is dry it is collected from the top, removing each rack as it becomes unloaded, thus gaining access to the lower tiers.—"B.J.," May 29, 1914, p. 423.

Drying Prints.—A suitable treatment for the mosquito netting (stretched on frames) on which to lay prints for drying is the following, given by G. T. Harris.—

A.—Alum		3 lbs.
	Soft water	160 ozs.
B.—Lead acetate		1 lb.
	Soft water	80 ozs.

Mix thoroughly, allow the precipitate to settle, decant, and soak netting for twenty minutes in the liquid. Wring lightly and hang in shade to dry. Treatment with this solution renders the netting waterproof. The frames may be of any suitable dimensions, and the netting is held in position on the frames by slipping the meshes over round-headed brass nails. Frames covered with material treated as above have been in continuous and hard use for the last six years without necessitating any renewal. If it is desired to dry the cards perfectly flat they may be laid face down on the netting without any fear of adherence. The trays when loaded are placed in a rack one above another, and the whole placed in a drying-room, or a gas ring or oil-stove may be lit underneath.—"B.J.," Apr. 3, 1914, p. 264.

Gelatine and Collodion P.O.P.

GELATINE P.O.P.

A Reliable Combined Bath.—A formula for a combined bath, which, as time has shown, yields lasting prints, and at the same time is one giving as good results as separate toning, is that of G. T. Harris :—

Sodium hyposulphite	2½ ozs.
Acetate of soda	¼ oz.
Ammonium sulphocyanide	¼ oz.
Gold chloride	3 grs.
Water	15 ozs.

The average time taken to reach purple brown is about ten minutes. Of course, care has to be exercised when using a combined toning and fixing bath that it is not overworked. The above quantity should tone and fix a little over a hundred cards.—"B.J.," March 20, 1914, p. 215.

Correcting Over-Toned P.O.P.—W. L. Amos recommends, as a method of occasional service, the baking of an over-toned P.O.P. print. The heat makes the print of a warmer tone, and the process is useful on occasions when time may not allow of a second print being made. The print is placed in an ordinary printing frame behind a moderately thick piece of glass. Back up the print with a couple of thicknesses of blotting paper, and adjust the springs as usual. Next suspend the frame about two feet above a gas ring, in front of a hot fire, or any other source of heat, care being taken that the heat is even, or the glass will be liable to crack.

In about from ten to fifteen minutes the print may be examined, and will generally be found to be warmer in tone, the degree, of course, depending upon the amount and duration of the heat, and to some extent upon the brand of paper used. Some makes are more amenable than others.

An alternative method for those possessing a dry mounter is to heat the press to about 100° F., place the print between two zinc plates, and screw down for the same length of time. After treatment the print will be found very curly, and it is as well to place it in a cool place for half an hour to regain its normal state of dryness, as otherwise if roughly handled the surface is liable to crack. This process is not infallible, but is put forward as a method that may prove useful when conditions make re-printing a matter of difficulty or impossibility.—"B.J.," April 3, 1914, p. 268.

Toning P.O.P. by "Colloid" Silver.—Miss Bertha E. Woolley and Charles W. Gamble have shown that the Neugschwender process (see "Toning by Colloidal Silver" under "Bromide and Gaslight Papers") is applicable to P.O.P. The P.O.P. print is fixed and washed and then bleached either with ferricyanide or the usual mixture of ferricyanide and bromide. It is then washed and treated with stannous chloride. On again washing and flooding with alkali solution pleasing brown colours are given. The tones produced when ammonia is used are the coldest in hue, the potash and the stannite show variations, being warmer in colour.—"B.J.," Dec. 26. 1913, p. 991.

Sulphide Toning of P.O.P.—T. Marshall recommends the use of sulphide for brown tones on P.O.P., using a sulphide bath of the same strength as employed in sulphide toning bromide prints The P.O.P. should be printed deeply, as it loses a good deal in the process; and after printing is washed in the usual way, and then fixed in plain hypo, to every ounce of which add five drops of liquor ammonia, to counteract any acidity that might be given by the salts in the paper. The prints after fixing must be well washed and dried. If the drying is omitted, blisters are almost sure to be met with. The dried print is bleached, rinsed, and then sulphided in the usual way. An alternative course is to place the dry print, without bleaching, in the sulphide bath. This gives a pleasant brown tone, and needs only the usual washing to complete the operation.—"Phot.," Sept. 22, 1914. (Compare "B J A.," 1906, p 813, 1907, p 778, and 1909, p. 593, for previous processes for toning P.O.P. with sulphide.—Ed.)

Developing P.O.P.—E. Valenta has worked out the following developer for faintly printed P.O.P. The formula is one which has been used for a considerable time in the Vienna School of Graphic Arts, where it has proved satisfactory for a variety of commercial printing-out papers. A stock solution is made as follows:—

Citric acid	17 gms.	150 grs.
Metol	4 gms.	35 grs.
Hydroquinone	6 gms.	50 grs.
Water	1,000 c.c.s.	20 ozs.

If kept in small well-corked yellow bottles filled to the stopper this stock solution keeps excellently. For use it is mixed with from 10 to 25 times its bulk of water, according to the negative and to the degree to which the printing is taken. The prints are laid, exactly as they come from the printing frame, in a dish, the developer poured over, and its action allowed to proceed by weak daylight, or better by lamplight, until the print is of sufficient depth. It is most important that in this process the dish should be continually rocked. From the developer the prints are transferred at once into a weak solution of common salt, of 1 to 2 per cent. strength, and are then toned.

Prints on matt paper, treated in this way, tone well either in the platinum bath alone or by the customary gold-platinum toning. The paper placed on the market by the firm of Gevaert as "Gravure" yields very fine results, as do also matt collodio-chloride papers and matt albumen papers when treated in the following way:—The prints are developed, passed through the salt bath, and then, after a short wash, are toned in a platinum bath made as follows:—

Potassium chloroplatinite	1 gm.	15 grs.
Phosphoric acid, sp. gr. 1. 127	15 c.c.s.	½ oz.
Water	600 c.c.s.	20 ozs.

They are then fixed in the usual way. In place of the platinum bath the prints may be first toned in a bath of borax and gold, and then in the platinum bath, according to the method which is cus

tomary with collodio-chloride papers. In the case of both glossy collodion and gelatine papers the prints may be developed and then toned with gold by either the separate or combined method.

A further point in the manipulation of the prints is of importance. The film should on no account be touched during development. To do so is the cause of light patches in consequence of the developing action not proceeding to the full. The developer can be used only once, but is so cheap that even if this were not the case it would not be worth while to use the solution a second time.—"Phot. Korr.," November, 1913, p. 512. "B.J.," November 21, 1913, p. 894.

Fixing Prints.—MM. Lumière and A. Seyewetz describe some most interesting experiments on the fixation of photographic prints. They show that in the case of all descriptions of print the use of a second fixing bath is a necessary condition for the complete removal of hyposulphite compound from the gelatine or collodion film.

The method of working recommended by MM. Lumière and Seyewetz is as follows:—

1. First fix as usual for about five minutes in a hypo bath, which may have been previously used, or tone in the combined bath, in the case of prints which are being treated in this way.

2. Wash the prints for about one hour, allowing them to drain clear of the wash water about every quarter of an hour, at the same time pressing the water from them before putting them to soak again.

3. Next place the prints for five minutes in a second hypo bath of 4 ozs. hypo to 20 ozs. water, keeping this solely for the second fixation.

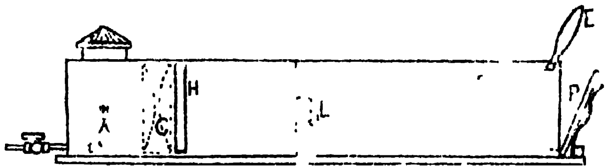
4. Again wash the prints for about an hour or an hour and a-half as after first fixing, and at the end of this time test with a drop of silver nitrate solution on the edge of a print. It should show no appreciable yellow colour after two or three minutes. When a certain number of prints have been passed through the second fixing bath it will be found that this result is not obtained after one and a-half hours' washing, the second bath having taken up too much silver salt. It is then used as the first fixing bath and a new solution made up for the second fixer. It should, of course, be added that no useful purpose is served by a second fixing bath where an eliminator or chemical destroyer of hyposulphite is employed for the removal of the last traces of hypo from the film.—"B.J.," November 14, 1913, p. 873.

Bromide and Gaslight Papers.

BROMIDE PAPERS.

Printing from Wet Negatives.—A. L. Wayland recommends the use of a fixed-focus box enlarger, with condenser, for printing from wet negatives by artificial light. The source of light found most suitable, on account of its constancy, is an old flat-flame burner. Incandescent gas is not sufficiently uniform in the light it gives for everyday work; a slight injury (or worse) to the mantle, an alteration in gas pressure, or even a shift in the position of the mantle

on its pin may make 50 per cent difference in the light; whereas the old flat-flame burner can be relied on to be *practically* uniform for six months on end. The apparatus is made of wood throughout, except the lantern end, which was furnished by an old dark-room lantern. The negative is inserted in the sliding holder at H. There is a condenser at C and an old R.R. lens at L. At P is a sheet of glass against which a padded board is pressed by a



spring. The wet negative is inserted in the apparatus, the board at P is pulled back, and a piece of bromide card is slipped in and the board allowed to press it to the glass. Exposure is made by pulling the lever E, which raises a flap. It makes a whole plate enlargement from a wet quarter-plate negative in twenty seconds or less, and as part of the equipment for rush work has proved invaluable.—"Phot.," April 7, 1914.

Vignetting Bromide Prints.—C. L. Bartley recommends as a means of securing softly graduated vignettes by artificial light, the use of a tunnel, about 8 ins. long and size about 6 × 6 ins., lined with strips of ordinary looking-glass. The mirror faces are all turned inwards. The light (incandescent gas) is just outside one end of the tube, while the printing frame is at the other end. The action of the mirrors is to reflect the light from various points of their surface, so that instead of the rays proceeding from almost a point, they emerge from the tube in all directions, as can be shown by noting the very soft shadow which is cast by the light coming from the arrangement.—"Phot.," November 11, 1913.

Vignetting Bromides.—The direct light from a small source, by which bromide printing is usually done, is not at all favourable to soft vignetting. When the exposures are being made on rapid bromide paper, it will be found that one of the best methods of illuminating the printing frame is to expose it to the light reflected from a large sheet of white card. The card itself may be illuminated by gas or electric light, a shield being used to prevent any direct light from the illuminant reaching the vignetter.—"Phot.," March 17, 1914.

Vignetting Bromide Prints.—H. Essenhigh Corke describes how to convert an ordinary printing frame into one serving conveniently for the making of bromide vignettes. A piece of ground glass is first fitted flush on the front of the frame. A convenient method of holding it in place is by means of a stout card in the form of a cut-out mount, this mount being firmly tacked down all round to the wooden frame.

Then, at the top and bottom of the front of the frame, two pieces of three-ply wood are tacked at either end, but left clear in the centres, so that the vignetting shape can be slipped under them and by them held firmly in position. The shapes themselves are.

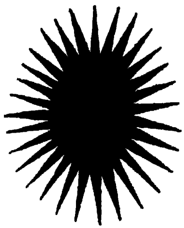


Fig. 1.

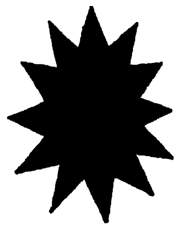


Fig. 2.

cut out of a thick art paper, and a series of these shapes should be made of various sizes, according to the general shapes and sizes most often required.

When cutting out the shapes very fine toothlike edges should

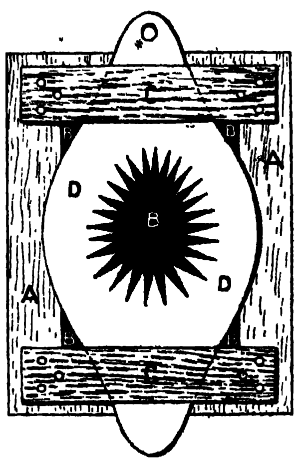


Fig. 3.

A. Wooden frame; B. Opening in shape, showing ground glass; C. Wood slip under which shape passes, D. Vignetting shape.

be made, each cut being fairly deep, as the finer and deeper the cuts the softer will be the resulting vignettes. For instance, cuts like Fig. 1 will give much better and softer vignettes than those like Fig. 2

The outside shape of the vignetting card found desirable is that shown, as this allows for very considerable adjustment in the position of the shape to counteract such faulty negatives where the head is placed too high, too low, or too much to one side of the plate. It is not necessary to make a similar frame to this for quarter-plate negatives, but much more simple to print the smaller sizes all in the same frame by using plate carriers, such as are used in one's dark-slides to accommodate these other sizes.

Where the light used to expose the prints by is so arranged that a diffusing screen of ground glass is between the light and the frame, no more adjustment is required, and it is not necessary continually to move the printing-frame about during the exposure: but where the light is naked, then a second piece of ground glass may be used with advantage about 1 in. away from the first piece In this case the most simple way is to use two printing-frames screwed together, the front one being fitted up as shown in Fig. 3, and the other one (in which the negative is to be placed) having a ground glass fixed on to its front.

By cutting the vignetting cards to the shape shown it will be noticed that just the four corners of the negative will not be protected from the action of light, and, of course, if a head at the side of the plate is being printed, still more of two corners will be unprotected; but as at no time will light be required in these corners, the ground glass nearest the negative should be painted at each corner in order to protect the print.—"B.J.," December 5, 1913, p. 932.

Renovating Stale Bromide Paper.—A formula for treatment of bromide paper, which has become stale and foggy in its result with age, is as follows :—

Potassium permanganate	1 gr.
Sulphuric acid	6 minims.
Water	10 ozs.

In the dark-room the defective sheets of paper are immersed in this bath for one minute. The paper is transferred direct from this bath to one consisting of 20 grs. of sodium sulphite to each ounce of water. It is allowed to remain in this for one minute, is then rinsed, and can be put, wet as it is, on the enlarging easel, and exposed right away. Or it may be dried and kept for future use. In either case the exposure will need to be about double that usually given.—"Phot.," May 5, 1914, p. 367.

Warm Tones Direct with Pyrocatechin.—F. Pospiech has published the following formula for a developer giving a tone of Brownish-black on ordinary bromide paper :—

Potassium carbonate solution, 10 per cent.	5 parts.
Pyrocatechin solution, 10 per cent.	1 part.
Water, distilled	12 parts.

The pyrocatechin itself is a pure white crystalline powder, which dissolves quite readily, the solution becoming of a slight brown tint, but keeping indefinitely when containing no alkali, in completely filled bottles. On addition of the potash carbonate it

becomes coloured, the solution first changing to green, then to yellowish brown, which colour, on the solution being shaken up with air, gradually changes to a deeper green.

The developer, as compounded for use, will not keep longer than twenty-four hours, so that any remaining from the development of prints should be placed in small bottles filled to the cork if to be used again within a few hours. The bromide paper employed in the tests was the Gevaert "Orthobrome," and required two seconds' exposure at 3 ft. from a 16 candle power lamp in order to give good prints from an average negative. The image appears in from 20 to 25 seconds, and is fully developed in about three minutes. The print is of brownish-black tone and of good vigour, and undergoes no change on fixing in plain hypo. Development can be stopped by the use of a bath of acetic acid or alum, but there is no particular advantage in doing so.—"Atelier," Heft 12, 1913, p. 140; "B J.," Dec. 19, 1913, p. 971.

Non-stress Developer.—F. J. Mortimer finds that the addition of hypo to the developer is a preventive of the dark streaks and hair-like markings on bromide and gaslight paper. The addition was found to work well with amidol, azol, metol-hydroquinone, and rodinal. The first-named was taken as the standard, and the formula used was—

Amidol	25 grs.
Sulphite of soda	300 grs.
Water	10 ozs.

A few drops of 10 per cent. bromide of potassium solution were also added. This formula was used to develop the first half of an experimental print, and the same formula, plus six to ten grains of hypo, was used for the second half, bringing about the entire abolition of the stress marks. It would seem that practically any published developing formula for bromide or gaslight paper can be used in the manner suggested.

The amount of hypo that can be added with safety to the developer without unduly slowing it or producing any bad effects appears to be fairly considerable; as much as 20 grs. was added to the developer with no other effect than the removal of the stress marks. Beyond that amount the action became slower, and subsequent experiments showed that if there was any tendency to under-exposure or for the developer to be exhausted, stains were liable to arise.

Given fresh solution and a properly exposed print, however, the presence of hypo is a distinct gain to the developer for bromide and gaslight prints, and bright, clean results can be secured every time. A careful comparison between the tones and gradations of the two halves of a print treated as described above showed no appreciable difference. There was also very little difference, if any, between the times of development of the two halves, although the prints developed with hypo in the developer took a trifle longer before visible developing action commenced.—"A.P.," March 16, 1914, p. 244.

Keeping Prints under Hypo.—As an aid to keeping a bromide or gaslight print under the surface of the hypo solution when first placing it in the bath, "Brazil" recommends a small block of wood, 3 ins. by 2 ins. for postcards, with four glass-headed pins stuck in at the corners, like legs. This commonly stands ready at hand in a spare dish with a little water in it, and immediately the print is put in the hypo the block is placed upon it, glass heads downward. It is most advantageous to have two fixing baths in use at the same time, and when half-a-dozen prints have been taken to move them one by one to the second bath. When another half-dozen prints have been put into the first bath the first lot is taken out one by one from the second, and put into a basin of water. This method, which really gives no extra trouble, ensures proper fixing.—"Phot.," Jan. 20, 1914.

Clearing Stained Bromides.—H. Underhill recommends as a certain means of removing yellow stain a hot mixture of alum (1 oz.) dissolved in 10 ozs. of water, 4 or 5 ozs. ordinary hypo solution, and about 20 minims nitric acid. The solution is used at a temperature a little short of boiling, the print having previously been hardened by half an hour's soaking in dilute formaline. The hot mixture, if allowed to act for a couple of minutes or longer, tones to a good sepia colour.—"A.P.," Jan. 5, 1914, p. 17.

Glazing Bromides.—C. Brangwin Barnes describes the following commercial practice for the glazing of bromide and gaslight prints without waste:—

Use glass for stripping prints from. Plate glass is best, but 21-oz. a good substitute.

When the glasses are new they should first be well cleaned with very weak ammonia or soda water and whiting, then dried and cleaned with methylated spirit. Very little spirit is required—just a few drops poured from the bottle on to the centre of the glass which is then polished with a soft duster, taking care that *both* sides of the glass are operated upon. After the glass has been used once it should never again be cleaned with anything else but methylated spirit—water, or spirit and water, will not do—and it will be found that all markings caused by the edges of the cards and splashes from the squeegee on those portions of the glass which have not been covered by prints will clean off very easily, and a splendid polish can be obtained with very little labour.

As a preventive of sticking a very good method is to treat the glass plates with dilute oxgall; the contents of one gall bladder added to 40 ozs. of water will be found to give satisfactory results. Care must be taken that the gall is fresh, as if it has gone bad it is worse than useless; the mixture should be filtered before using, and then applied in the same manner as the spirit which has been used for cleaning the glass, with the difference that while the spirit was used sparingly, the oxgall should be somewhat more lavishly employed, and care must especially be taken that the extreme edges of the glass receive their due quotum.

This method is undoubtedly a good one—the prints come off easily

and with a good surface; the only drawback is that should the solution go bad and be unwittingly used the prints will stick. Petrol may be employed instead of oxgall, but, of course, in a pure state, and the great drawback in this case is that it must not be used in a room where there is gas or any artificial illumination other than electricity.

With glasses cleaned and polished with methylated spirit, it will be found that the most certain means of ensuring the prints all coming off properly is again to polish with French chalk (powdered talc); the system is one of the oldest, and in the opinion of experienced workers is still the best, but bear in mind that the chalk must be properly rubbed into the interstices of the glass and *all over it*, not, as some boys or girls do, rubbing it on and then off again. It must be borne in mind that the object in French chalking the glass is to provide a substratum which will prevent the prints from sticking to the glass when dry, and not, as some workers seem to imagine, further to clean and polish the glass. The prints should then be taken from the water and laid in their places, and when the glass is filled they should be covered with a piece of waterproof sheeting and lightly squeegeed with a flat squeegee; those on the first side can be examined to see that there are no air bubbles left, but it must be obvious that when the second side is filled they cannot be so examined, and, therefore, care must be taken that the squeegeeing is thoroughly and effectually done. All that now remains to be done is to get the pictures dry, and not only dry, but in just the condition that they will either drop off the glasses on their own account or will strip off without any necessity to pull them—in fact, they should only need one corner raising for them to at once detach themselves bodily; and here it will be found that one of the most necessary elements of successful glazing is drying the prints properly and thoroughly, and knowing when they are just in the perfect condition for stripping. Spontaneous drying is what is really required, and heat should never be applied, as with any trace of moisture in the paper there will be at once a tendency partially to melt the gelatine, and even if the print is taken off the glass entire it will be found to be marked or cracked where the partial melting has occurred.

It will be found far the best to place the glasses in a rack (and not close together) in a room in which a fire is burning, but the rack should not be placed near enough to the fire for the heat to be appreciable. What is required to dry the pictures in a proper manner is simply dry air. In fine weather they may be successfully dried in the open, but should on no account be placed in the hot sun. Drying should be complete in a space of about three hours, but if the atmosphere is damp the time is naturally prolonged, and if prolonged to excess failure is almost sure to result, as the gelatine has a tendency to decompose if exposed too long to damp.

It will be seen by the foregoing that the main elements of success are, firstly, thorough cleansing of the glasses with spirit; secondly, thorough and careful French-chalking; and, thirdly, *natural* drying. With the ordinary thin paper a gentle heat may sometimes be applied after the print is surface dry and is required in a hurry, as for Press work, but with the thick or postcard paper, even when the

surface appears perfectly dry, there is still moisture beneath the surface, and the application of heat will at once generate steam and cause melting of the film, and directly melting occurs sticking is bound to follow.

Should a glass become faulty from scratches, a piece of paper should be stuck on the side where the defects are, so that when preparing the glass that side should not be accidentally chalked and covered with prints, as might otherwise easily occur when many glasses have to be prepared, and sometimes in a poor light.—"B.J.," Oct. 17, 1913, p. 798.

GASLIGHT PAPERS.

Adurol for Warm Black Tones on Cyko.—Dr. E. Stevens uses the developer given below for warm-black tones on "normal platinum" "Cyko," giving from a thin negative about 10 to 15 seconds at 7 ins. from a 50-candle-power frosted Osram bulb:—

A.	Adurol-Hauff	10 gms.	150 grs.
	Sodium sulphite (cryst.)	100 gms.	3½ ozs.
	Water	500 c.c.s.	18 ozs.
B.	Potassium carbonate	60 gms.	2¼ ozs.
	Water	500 c.c s.	18 ozs.

For use take one part of A, one part of B, and add one part of water, and for every ounce so made up add ten minims of a 10 per cent. solution of potassium bromide.

The full quantity of bromide, about 1 gr. per oz., must be used in order to get the warm colour. The developer should be used at 65°, and will be found to take two or three minutes, so that it is well under control, there being no sudden flashing up of the image and a frantic dash to place the print in hypo. If the exposure has been fairly correct, a stage will be found when the intensity of the image hangs fire; the print should then be plunged into a dish of clean water for a moment, and then placed in a good deep dish of acid hypo for fifteen minutes. This is followed by a wash in running water of half an hour.—"A.P.," January 5, 1914, p. 6.

Light-Tone Gaslight Prints.—S. Marfield suggests thickening the developer for gaslight prints with sugar syrup as a means of reducing its speed of action, and so of obtaining prints of grey tone as a result of stopping development at an early stage With the full strength developer, or with addition of water, it is almost impossible to stop the action at the required stage. The syrup is made by dissolving 2 or 3 ozs. of sugar in a very little hot water. With syrup of about the consistency of treacle 1 part of syrup to 2 of the ordinary developer will be a convenient strength, and even when development is prolonged to three or four minutes the whites remain clear, whilst the tone of the picture is a pure grey.—"Phot.," Sept. 8, 1914, p. 207.

Coloured Tones by Development.—Dr. R. Fischer has patented a process of making coloured photographic pictures, consisting in latent pictures obtained in halogen-silver films being developed with such

developers as contain, besides the developing substance, a body which couples itself with the oxidation product of the developer to form a coloured body soluble with difficulty.

It is found that very highly coloured pictures can be very readily obtained not by using the oxidation products of the developers alone, but by adding to the developers substances which become coupled with those oxidation products of the developer which are formed whilst developing and form coloured bodies soluble with difficulty. According to the developers or coupling bodies which are employed, we obtain representatives of various classes of colouring materials or dyes.—Eng. Pat. No. 2,562, 1913. "B J.," April 24, 1914, p. 329.

Toning Bromide and Gaslight Prints.

SULPHIDE TONING.

Sulphide Toning Processes.—S. E Flower, in a review of methods of sulphide toning, states that he still prefers the iodine bleaching bath of R. E. Blake Smith, although it entails extra washing and sulphite bath, but it is found best for deep sepia tones. A method found excellent for cool brown tones is that of T. H. Greenall, in which a bleaching solution containing phosphate is used, the original print being developed with amidol. ("B. J. A.," 1913, p. 657.) The bleacher is :—Sodium phosphate, 240 grs.; potass ferricyanide, 40 grs.; water, 4 ozs. The print gradually lightens in this, but never bleaches to a very great extent. It is left in until there is no doubt that the solution has acted as much as it will. Then it is washed for two or three minutes and darkened with sulphide—"Phot.," June 23, 1914, p 513.

Permanganate Bleach Method—David Ireland, in recommending the use of a bleaching bath of acid permanganate, as advised by T H. Greenall ("B J A," 1914, p. 655), finds it best to start with a solution containing the full quantity of acid, adding to this, in small doses, the stock solution of potassium permanganate. In this way browning of the paper back of the print provides a sign that very little more of the permanganate solution is required. A stock solution is made of ½ oz. potassium permanganate in 20 ozs. of water. To bleach a 10 x 8 or 12 x 10 print ½ dram hydrochloric acid is mixed with 10 ozs. water; to this is added *not more than* ½ dram permanganate solution, the mixture being poured over the print. As bleaching proceeds the fluid loses colour, and should the subject be a heavy one and the action hang fire, measure out another ½ dram permanganate solution, dilute with a couple of ounces of water, and add in driblets until bleaching is complete—"A P," May 11, 1914, p. 447.

Sulphide-Copper Toning.—H. M. Ward has patented an improvement in the process of sulphide-ferrocyanide toning, described in Patent No. 8,002. 1912 ("B.J.A.," 1914, p. 659). It consists in alternative methods of combining a silver sulphide image with one of copper ferrocyanide. A silver print or transparency is first

sulphided, then toned in a copper toning bath to which has been added a suitable silver solvent, such, for instance, as sulphocyanides, persulphates, or chromic acid. As an example, copper sulphate, 60 grs.; potassium citrate, ½ oz.; potassium ferrocyanide, 50 grs.; ammonium sulphocyanide, 200 grs.; water, 20 ozs. A bromide, chloride, or similar salt may be added to the copper bath. The chloride or any other form of copper (that will produce the ferrocyanide tone) may be employed in place of the sulphate. Any other copper toning formula will answer with the addition of some suitable quantity of sulphocyanide.

An alternative method is to tone a silver print or transparency in the previously described bath, or any other copper toning baths (which produce a ferrocyanide image wholly or in part), and, after clearing and washing, treating the copper-toned image with a sulphiding solution made acid with sulphuric or other acid. Quantities may vary, but 40 grs. sodium sulphide and ½ dram sulphuric acid to the pint will serve as an example. The print is afterwards well washed.—Eng. Pat. No. 6,026, 1913; "B.J.," May 29, 1914, p 423.

Liver of Sulphur Toning.—R. R. Rawkins, in a demonstration at a professional exhibition, adopted the formula and process described by him as follows :—

Liver of sulphur	¼ oz.
Hypo	½ oz
Water (warm)	20 ozs.

The liver of sulphur should be washed for a short time until it shows its true colour—a deep brown. The toner is used warm—about 80° F.—and therefore it is advisable to use an acid-alum fixing bath when fixing prints which are to be toned. It is necessary to wash the prints only slightly, so as to remove the acid. Prints can then be placed in the toner. They appear to become deeply stained yellow at first; in about ten minutes the toning will be complete. On removing from the toning bath the prints do not appear to be fully toned, but when the yellow discoloration is removed by washing, the tone is seen.

As regards the colour produced on bromide papers, it closely resembles that given by hypo-alum, being distinctly on the cold side. Like hypo-alum, it gives warmer tones on prints that have not been fully developed, but in one direction it scores over hypo-alum in that it has no bleaching action or cutting out of the fine half-tones; in fact, it has no perceptible influence on the depth of the print.

With gaslight prints the toner gives beautiful tones of a distinct sepia, and toning is complete in less than ten minutes.

After toning, the prints should be well washed until all the yellow colour has gone, and dried as usual. The surface feels slimy in the toning bath, and with some papers there are dirty marks visible. These marks can easily be rubbed off when the prints get their usual wipe before drying. Glossy bromides retain their gloss after squeegeeing.

The only failures were caused by blue spots appearing in a few prints at first, but after washing the liver of sulphur and using a

clean, unchipped steel enamelled dish, these spots no longer made their appearance.

The bath does not keep, and should be made up freshly every time. It is cheap, as liver of sulphur is about 7d. a pound.—" B.J.," March 20, 1914, p. 218.

Subsequently, in a letter to the "British Journal," R. R. Rawkins expresses his regret at having overlooked the fact of a mixture of hypo and liver of sulphur being covered by the patent of E. Fenske, No. 18,545, 1912. He points out that the toning solution, or licences to compound it, are obtainable from Mr. Fenske, 46, Osborne Road, Thornton Heath, London, S.W.—" B.J.," April 10, 1914, p 293.

Bleaching Sulphide-Toned Prints.—R. E. Blake Smith gives as the best bleaching bath for a print which has been sulphide-toned and requires to be re-converted into one of black colour the following :—

Solution A.

Potassium permanganate	10 grs
Water	5 ozs.

Solution B.

Sodium chloride	½ oz.
Alum	½ oz.
Concentrated sulphuric acid	25 minims.
Water	5 ozs.

The actual bleaching bath is compounded by taking 1 part of solution A and adding it to 4 parts of solution B. This bleacher works very quickly, and it does not give off noxious chlorine vapour, but is quite pleasant to use. The print is first soaked for two minutes or so in water and then immersed for ten minutes in a saturated, or nearly saturated, solution of alum. After this it is rinsed under the tap for a few seconds and then put into the permanganate-chloride bleaching bath.

After bleaching there is almost always left a slight yellow stain (oxide of manganese) on the paper, especially where bleaching has taken place—*i.e.*, on the parts previously occupied by the image. It is best to remove this stain before re-development, and in order to do this the print, after rinsing, is placed in :—

Alum	½ oz.
Sodium sulphite (cryst.)	6 grs.
Concentrated sulphuric acid	5 minims.
Water	5 ozs.

and when the stain has disappeared, the print is washed in running water for about ten minutes, and then redeveloped in :—

Amidol	6 grs.
Sodium carbonate (cryst.)	6 grs.
Sodium sulphite (cryst.)	35 grs.
Water	2 ozs.

Finally, a thorough wash brings the process to an end.—" B.J.," June 26, 1914, p. 492.

Colloidal Sulphur.—Julius Meyer, in a paper before the German Chemical Society, has given a method for preparing colloidal solutions of sulphur or selenium. The sulphur, or selenium, is dissolved in a few c.c.s. of hydrazine hydrate, and the solution is energetically shaken. When a saturated solution has been made a syrupy, dark-coloured liquid is obtained. If a few drops of this solution are added to some litres of water, stirring thoroughly with selenium, a red-coloured solution is obtained, and with sulphur a whitish-yellow solution. The selenium solution is exceedingly stable, and can be boiled for some time without undergoing any change. It can be kept for months. When it is allowed to stand for some time a small quantity of red selenium separates, but it disappears on shaking. The sulphur solution is not so stable as the selenium solution.—"B.J.," December 26, 1913, p. 994.

OTHER TONING PROCESSES

Quinone Toning Bath.—E. S. Maples writes in praise of the quinone toning formula of MM. Lumière ("B.J.A.," 1912, p. 644) for bromide prints or lantern-slides. A suitable formula is quinone, 1 part; potassium bromide, 5 parts; water, 200 parts. This mixture keeps for not more than one hour, and should be strained through cambric before use. The tones which it yields are from brown to red chalk. An after-bath of 10 per cent. ammonia increases the contrast and, at the same time, changes the tone to a warm black. It is necessary to use it for lantern-slides as it also removes the slight opalescence left by the toning bath.

A very excellent after-bath is the Cubrome thiomolybdate toner "A.P.," March 9, 1914, p. 225.

Toning by "Colloidal" Silver.—Miss Bertha E. Woolley and Charles W. Gamble, in a lengthy paper, have described the results of a research carried out at the School of Technology, Manchester, on the method of intensification and toning suggested by Neugschwender and described by him as due to colloidal silver. The silver image, on a negative or bromide print, is converted into silver ferrocyanide by means of potassium ferricyanide solution, rendered alkaline. It is then treated with stannous chloride, followed by solution of a caustic or carbonated alkali, this last treatment producing an image of brown colour. The authors have tested the effect of many other tin compounds in the process, and have examined the effects also of other variations, such as different alkalies, bleaching solutions, etc. They have shown the very considerable range of tones of which the process is capable.—"B.J.," Dec. 26, 1913, p. 987.

The Carbon Process.

Tank Development of Carbon Prints.—G. T. Harris recommends the following as a very satisfactory method where carbon prints to the number of a couple of dozen or so are being made: Suppose the size of the paper upon which the tissue is mounted is 12 x 10, then 12 x 10 plates are taken and rubber bands stretched over each end. Under these the prints are slipped, the band crossing

the plain margin of the paper, of course. The plates are dropped into wood tanks with wide V grooves, two in each groove, back to back. The tissue being stripped, the prints can then be left to take their own time for development, and there is no fear of abrasion marks occurring from prints sliding across each other when the tissue is in a soft condition.—"B. J.," March 20, 1914, p. 214.

Substratum for Carbon Transparencies.—A very simple substratum for coating glass for transparency work is given as follows: Take the white of a new-laid egg, beat up well, and add slowly 2 ozs. of water, taking care to keep stirring the whole time; add to this one drachm of saturated solution of chrome alum. The substratum will have a blueish opalescent appearance, but should it be at all stringy, filter through fine muslin or cotton wool.

Clean the glass well and apply the coating with a broad camel-hair brush. A quantity can be coated at once and placed away for future use. It is difficult to find which side of the glass has been coated when dry, but this can be obviated by sticking a gum strip on the uncoated side. The tissue will be found to adhere to the glass equally as well as in the gelatine method, and is less messy.

In the double transfer carbon process, using ground opal as a temporary support, a coating of this substratum will give most excellent results, blisters being reduced to a minimum. The albumen holds the delicate high lights together and the finished prints leave the support with ease. A spoilt print should not be removed from the opal by any other means but transfer paper; scrubbing spoilt prints from the opals spoils the surface, and will cause future prints to stick. Old transfer should be kept for this purpose.

By adopting this method the opals will only require waxing once or twice first; should the prints show any inclination to stick in final transfer, a little petrol rubbed over the opals will do all that is necessary. An excess of wax will cause blisters, and the surface of the finished print will appear smeary.—"B.J.," June 12, 1914, p. 459.

Quick Drying Sensitiser.—Achille Carrara has published the following formula for a quick-drying sensitiser consisting of pure ammonium bichromate and ethyl alcohol with a minimum quantity of water—viz., only that necessary to obtain the solution of the bichromate in the alcohol.

A stock 20 per cent. solution of ammonium bichromate (pure) is prepared as follows:—

Ammonium bichromate (pure)	20 gms.
Water, to make up	100 c.c.s.

and we have that every 10 c.c.s. of this solution contain 2 gms. of bichromate, whilst 5 c.c.s. contain 1 gm.

To make up the sensitising baths

For a $2\frac{1}{2}$ per cent. bath take	stock solution	5 c.c.s.
	ethyl alcohol	35 c.c.s.
For a 3 per cent. bath take	stock solution	5 c.c.s.
	ethyl alcohol	28 c.c.s.

For a 4 per cent. bath take stock solution 5 c.c.s.
ethyl alcohol 20 c.c.s.
For a 5 per cent. bath take stock solution 5 c.c.s.
ethyl alcohol 15 c.c.s.

To sensitise the tissue, pin the latter up in cut sizes to a piece of board in a vertical position by the four corners, placing a sheet of blotting paper between it and the board. A convenient method is to pin up two or three pieces of tissue side by side on the dark room door. With a broad camel-hair brush dipped in the solution the surface of the first sheet of tissue is painted over with rapid strokes of the brush, first across, starting from the top, and then up and down, taking care not to have the brush too wet and not to wet the back of the tissue by letting solution get over the edges of the tissue.

Paint the solution on the three pieces of tissue rapidly in succession and then start over again, commencing from the first one. In this way the tissues should each receive three successive coats of solution and should then be hung up to dry. In fifteen to twenty minutes the tissue is ready for use. If an electric fan or a fire is in the dark-room, drying takes place even quicker.

This method enables one to have fresh tissue within twenty minutes and sensitised in a bath of the requisite strength to suit negatives of varying density. The made-up sensitising bath, after being once used, should not be kept, as it becomes turbid within a few hours, hence the advantage of being able to make up small quantities as required and as shown in above formulæ.—"B J." Colour Supplement, Jan. 2, 1914, p. 3.

The Ozobrome Process.

One-Bath Ozobrome.—W. R. Jackson prefers to use the acid and pigmenting solutions mixed together, as was the practice in the early days of the Ozobrome process. But he combines the two in proportions, adjusted according to the final result required It is found that the mixed solutions keep quite satisfactorily. A table, giving the proportions of the two solutions for various descriptions of work, is as follows :—

Parts by Volume of Diluted Pigmenting Solution.	Parts by Volume of Chrome Acid Bath.	Result.
3	1	Plucky Ozobromes from flat grey bromides.
11	4	Ozobromes of the same density and contrast as the original bromide.
5	2	Normal Ozobromes from dense or contrasty bromides.

The bromide, after being well fixed, washed, and dried, is trimmed, so that no trimming is required on the final Ozobrome.

The tissue is soaked for about three minutes in the mixed solution and then brought directly into contact with the bromide print under water, finally squeegeeing into close contact on a glass slab.

Ten minutes is ample for the print to bleach. The print is then transferred to the transfer paper in the usual manner.—" A.P.," Nov. 15, 1913, p. 546.

Ozobrome on Bromide.—T. H. Greenall gives working details of the method of securing specially good and strong effects by intensifying a correctly exposed, but lightly developed, bromide print by means of Ozobrome. The results are characterised by richness in the shadows and full detail in the high-lights, whilst the process is one which admits of great control.

The starting point is a soft enlargement on a smooth, not glossy, bromide paper. Chiffon or other diffusing means should not be used. The paper should be exposed for the minimum time which will give detail in the high-lights with a soft-working developer without bromide. A suitable developer is: Metol 1 grain, potassium metabisulphite ½ grain, sodium sulphite 6 grains, caustic soda 2 grains, water 4 ounces. Fresh solution must be used for each print, and development must be completed in from two and a-half to four minutes, according to the character of the negative and subject. Prints with greater contrast are obtained by using six grains of potassium carbonate in place of the caustic soda, but perhaps in some cases the character of the water supply may affect the result when caustic alkalies are used. The metol is kept separately (with the metabisulphite) in a 1 in 80 stock solution. For those who prefer a ready-made developer, ten minims of Azol to the ounce of water may be recommended.

The prints, after fixing and washing, must be hardened in a solution of chrome alum, of a strength of twenty-four grains to the ounce, for ten minutes—not for longer—and then are again washed for a few minutes.

The Ozobrome print can be applied to this bromide either at once or after drying, in the latter case after first soaking in water. The Ozobrome solution bleaches the silver image and the latter is either re-developed or sulphided. Hence the colour of the Ozobrome tissue needs to be chosen according to which of these two treatments is adopted. For re-developing, Illingworth's "Gravure Platinum Black" is very suitable: "Gravure Special X," for sulphide toning.

In making the Ozobrome the following procedure was found best. The stock solutions required are as follows:—

SOLUTION A.—This is the concentrated Ozobrome pigmenting solution as sold.

SOLUTION B.—This consists of water 2 ounces chrome alum 13 grains, potassium bisulphate 2 1-5 grains, citric acid 1 grain.

SOLUTION C consists of citric acid 1 grain, water 1 ounce.

SOLUTION D.—Water 1 ounce, potassium bisulphate ½ grain.

The "working strength acid bath" given in the Ozobrome leaflets is the same as solution B. An alternative formula is also given, which substitutes the same weight of oxalic acid for the potassium bisulphate. Solution C is prepared fresh from a stock solution which is preserved with a few drops of chloroform, or one drop to the ounce of carbolic acid. Solution D is prepared from a stock solution which keeps perfectly.

For use, supposing that it is a half or a whole-plate print which is being worked, 30 minims of A, 40 minims of B, and 10 minims of C may be taken, with water to make 150 minims. If a more delicate result is required, we may try 30 minims of A, 45 minims of B, and 15 minims of C, with water to make 150 minims, whilst if the bromide is of the chalky sort, a solution may be used, made up of 30 minims of A, 30 minims of B, and 10 minims of D, with water to make 150 minims.

The effect of D in excess is to veil the high-lights, whilst citric acid in excess gives washed-out high-lights. This, however, is not necessarily fatal when the bromide print is going to be re-developed underneath. Each worker should experiment for himself with trial strips of his bromide prints which are of a similar character and have received the same development as the bromide print that is to be "Ozobromed."

The next proceeding is to take a piece of the Ozobrome tissue, and to hold it under water for a minute, or until it is limp, and then, after draining off all surface water, to place it face upwards on the sheet of glass. The solution is next spread over the surface of the tissue with the aid of the camel-hair brush, the action of the brush being kept up for exactly two minutes. Two drams of the solution will be found ample for a piece of tissue 7 x 5 ins. The brush, of course, must be dry to start with, or, at any rate, should be squeezed out as dry as possible.

At the end of the two minutes, the sponge, charged with water, is passed lightly over the tissue for a few seconds to remove the excess of surface solution, and the bromide, which should have been already soaking in water, is placed dripping with water face downwards on the tissue and instantly squeegeed down. None of the sensitising solution must touch the bromide print, either from the fingers or otherwise, until it reaches the tissue, and, once put down, there must be no attempt at adjusting.

The Ozobrome is developed on the bromide as in the carbon process, and after a brief wash the underlying bleached bromide print may be re-developed with freshly mixed amidol, without bromide, or sulphided as in ordinary sulphide toning. If the final print appears too heavy, the developed image on the bromide can be reduced with hypo and ferricyanide, but not unless the Ozobrome deposit in the high-lights is sufficient, since the ferricyanide destroys the detail of the bromide first in the higher tones.—"Phot.," March 17, 1914, p. 227.

The Bromoil Process.

Bromoil Bleacher.—H. Featherstone gives the following formula for a bromoil bleacher, which permits of prints being very easily

inked up, and, further, does not require the print to be soaked in a bath of sulphuric acid.

Copper sulphate	40 grs.
Sulphuric acid	2½ minims
Potassium bromide	40 grs
Potassium bichromate	3½ grs.
Chrome alum	8 grs

Dissolve above in 10 ozs. water, and use at a temperature of 90° F.

The dry bromide or gaslight print is immersed in this solution, and after five minutes the image will have bleached until hardly a trace is seen. This bath also hardens the gelatine at the same time, which enables it to stand the brush-working well.

The print is then washed five minutes and fixed in hypo, 3 ozs, to one pint water, to remove the soluble silver that in time might show effects of darkening, afterwards being washed thoroughly to remove the fixing agent. At this stage the image can be seen in relief, and when the surface moisture is dabbed off with a soft cloth the print is ready for inking —"B J.," November 14, 1913, p. 884.

Bromoil Bleacher, etc.—A H. Gardner has published the formula of the bleacher previously sold by him as "Silvax" It is:—

Sulphate of copper anhydrous	80 grs.
Salt	720 grs
Bichromate of potash	15 grs.
Water	24 ozs

This mixture to be used until exhausted

Instead of the white anhydrous copper sulphate, 130 grs. of the crystals (blue) can be used

As first sent out, the "Silvax" solution had added to it an acid salt (ammonia alum) for the purpose of forming a clear solution. But afterwards the alum was discarded and the solution of the powder was rendered acid by addition of a few drops of sulphuric acid But it has since been found that the deposit is not of importance and can be disregarded or filtered off

In endeavouring further to improve the "Silvax" bleacher use was made of chloride of copper *plus* salt in one solution with potassium bichromate in another solution, according to the following formula —

(1) Chloride of copper	64 grs.
Salt	480 grs.
Water	4 ozs.

(2) Saturated solution of bichromate of potassium.

The worker must experiment for himself with the particular paper or papers which he uses. The simplest way is to keep No. 1 solution constant, and vary the bichromate For instance, here are three variations, the middle being about normal:

(*a*) No. 1, 1 dram and 1 dram water. No. 2, 2 drops.
(*b*) No. 1, as above. No. 2, 4 drops.
(*c*) No. 1, as above. No. 2, 8 drops.

Generally speaking, the stronger the bichromate the slower the action and the stronger the tanning action.

Each of the above quantities is sufficient for a quarter-plate print, and after use the bleacher should be thrown away. The print should be soaked in water until limp before bleaching.

As to temperature, it is sometimes an advantage to raise the temperature to 80 to 100 degs. F., especially when bleaching a hardened gelatine print. The tanning action in such cases appears to be more thorough, and the relief more pronounced. But ordinary temperatures (55 to 70 degs.) with most gelatines is sufficient. It is not found that there is any *striking* evidence in favour of high temperatures, except to suit special cases If the bleacher is adjusted to suit the print, correct chemical action follows, and, generally speaking, temperature can be ignored, provided extremes are avoided.

The colour of the print after bleaching and rinsing in water is important, and affords a reliable clue as to the efficiency of the bleacher. After bleaching and washing, the image should be a bright lemon yellow. The whole image dissolves very easily in an acid fixing bath, such as Agfa rapid fixing salt, and with some papers (soft gelatine papers) this is sufficient

The same result can be reached with

(1) a very weak sulphuric acid bath (even one or two drops to the ounce of water), which quickly removes the yellow image

(2) A plain hypo bath (2 ozs. to the pint of water), which quickly dissolves the rest of the deposit, leaving just a colourless suspicion of an image

After the acid bath the print should be well rinsed, so that the acid remaining is negligible

The use of sulphuric acid has been much discussed Some workers have strongly discouraged it, others always use it, even up to 5 per cent. strength and more Good and correct bleaching being presumed, the use of sulphuric acid has no deleterious effect, provided the strength and temperature are not overdone. And these must be suited to the degree of hardness of the gelatine. A tough, almost insoluble gelatine can be treated with a 2½ to 3 per cent. bath (stronger is seldom called for) at 70 to 90 or 100 degs., and left to soak until the toughness of the gelatine is gradually broken up and the relief makes its appearance. The effect of a weak sulphuric acid bath used at a high temperature is similar to that of a stronger bath used at a lower temperature, and with some papers warm water is sufficient alone. Gelatine, strength of acid bath, and temperature are inter-dependent, one upon the other, and must be determined by experiment. As a general indicator of treatment for experimental purposes the following is given:

In the case of a hard, insoluble gelatine:

(1) Bleach at a temperature of 80 degs. or more, using a bleacher fairly strong in bichromate.

(2) Use a 3 per cent. acid bath and raise the temperature gradually to 70, 80, or 90 degs., until sufficient relief is observable.

(3) Then wash and fix.

In the case of a soft gelatine:

(1) Bleach at normal temperature (say 65 degs.) in a bleacher containing less bichromate.

(2) Rinse and fix in an acid fixing bath, or wash in acidulated water (two drops sulphuric acid to the ounce), and fix in ordinary hypo.

(3) Soak in water and gradually raise the temperature to 80 or 85 degs. until relief is strong enough

Within reasonable limits sulphuric acid and warm water appear to bring about proportionate softening, which is what is required. Ammonia, on the other hand, as already mentioned, gives general softening, which is most apparent in the loss of high-lights, such as cloud gradations. It is best avoided.

First, correctly bleach your print, and then trust to plain water or acidulated water and a raised temperature to get your relief.

The majority of failures can safely be put down to imperfect bleaching—that is, "imperfect" as regards the end in view, which is to endow the gelatine film with certain properties upon which the process is based.

The causes of these failures are:

(1) The use of a hard and fast bleaching formula for all papers.

(2) The possible deterioration of the stock solution, used or unused

(3) The use of stock solution which has been partially exhausted in some essential

(4) Attempts to tinker up the stock solution by adding other things.

Such sources of failure are removed by (1) using a correctly adjusted bleacher, and (2) by using fresh solution each time. The test of proper bleaching is a distinctly yellow image, and a good test of correct after-treatment is a reasonable amount of relief.—"A P.," Oct. 20, p 359, and Oct. 27, p. 389, 1913.

Bromoil Formulæ.—Dr. S. Brum Do Canto gives the following formulæ as those found most effective as the result of making trial of a very large number of published prescriptions. For the development of the bromide print a weak, followed by a strong, amidol developer is used.

I.—Weak Developer.

Soda sulphite (anhydrous) ...	5 gms.
Amidol ...	1 gm.
10 per cent. bromide solution ...	1 c.c.
Water ...	800 c.c.s.

II.—Strong Developer.

Soda sulphite (anhydrous) ...	5 gms.
Amidol ...	1 gm.
10 per cent. bromide solution ...	4 c.c.s.
Water ...	200 c c s

When the image has completely appeared in the first developer, transfer it immediately to the second developer, where development is quickly finished

The print is then quickly passed into a 5 per cent. solution of liquid soda bisulphite and transferred to the hypo.

The fixing bath is one consisting of equal parts of a 50 per cent. solution of hypo and a saturated solution of boric acid, in which prints are fixed in from 10 to 15 minutes; longer does no harm

Before bleaching prints should be soaked in water for not less than twelve hours in summer or twenty-four hours in winter. The formula found best for the bleaching bath was as follows :—

Copper sulphate	40 gms.
Potassium bromide	20 gms
Potassium bichromate	1 gm.
Water to make....	1,000 c.c.s.

This bath bleaches remarkably quickly, and it is most important to remove the print as soon as bleached and to wash in running water for five or ten minutes. The relief is then as good and strong as that obtained only by the use of hot water and a bath of sulphuric acid when other bleachers are used. The print is then fixed in a solution of hypo, 3 ozs.; water, 20 ozs ; and after a further twenty minutes' washing is ready for pigmenting. A good method of washing is to press the print, after several successive soakings, with a wet chamois leather.

For pigmenting the method found best is that of Namias :—A small portion of hard ink is carefully mixed with ten times its bulk of very finely rectified turpentine. Charge immediately the brush with this mixture and dab it quickly upon the whole surface of the print, wihch will become covered with a fine coating of ink. Continue the dabbing action of the brush. Gradually from the nebulous print the high-lights appear, the shadows intensify, and detail grows. It follows that, with the gradual evaporation of turpentine both on the print and on the brush, the ink becomes thicker and passes from the print to the brush in the high-lights, and from the brush to the print in the shadows. After a short time of dabbing the whole image is very clear. Only the lightest tones do not resist this first treatment, but never mind them : continue the dabbing until obtaining detail in the shadows.

This first part of the inking being complete, take three parts of hard and two parts of soft ink, and dissolve the mixture with some four or five times its bulk of the following medium :—

Rectified turpentine	1 part
Petrol	2 parts

This second ink is intended for the lighter tones, and will be worked up quite in the same way as the former, the sole difference being that it must not be used so fluid, in order not to modify the effect of the former inking.

Where any lack of intensity is found, supplementary inking with this second ink will be made, the excess of ink being removed by

continuous dabbing. It is marvellous how quickly a Bromoil print is made in this way

If the worker is not satisfied with the resulting print all the pigment can be instantly removed with a fine cloth and benzine, the print is soaked in water for five or ten minutes, and is then ready to ink up once more.

Professor R. Namais insists upon the use of very finely rectified turpentine, saying that ordinary turpentine usually contains greasy matters, which make it inconvenient for the process, and recommends only distilled and very volatile turpentine. This point is certainly of the highest importance, and even when using distilled turpentine great care must be taken in well corking the bottle, because evaporation of the most volatile parts gradually increases the density of the remaining portion, which becomes quite unsuitable for the process

An important point is to work quickly. To obtain the best results cover the surface of the proof, in the beginning of the first inking, with the proper quantity of ink. Too much ink will lead to hard, too little to soft results.

For the first inking by this method the largest putois pied-de-Biche brushes are the most convenient —" B J ," Aug 14, 1914, p 626

Masking as a Control Means in Pigmenting Bromoils.—H. Wild recommends the use of a mask for protecting part of a Bromoil print when inking up, for somewhat greater depth of tone, a given portion of the print. The mask is useful, particularly when there is a sharp outline up to which the action of the inking brush requires to extend. The mask is conveniently made of extra fine tracing paper. A piece of the paper is placed over the print, and the outline of the part to be masked marked out with a fine pencil, and carefully cut out with a fine pair of scissors The paper cuts very cleanly, does not tear, and lies flat. In the case of intricate details one must not try to cut them all out, but rather to generalise them It is better that the mask should be a shade larger rather than small If large (in these complicated places) it merely means a few light spots to be taken out afterwards, which can easily be done with a fine brush and the pigment, using paraffin oil as a medium. If the mask is cut inside the line it means a dark line or spots on the print, which are a good deal more trouble to take out.

Having made the mask, it is adjusted over the print and secured by a couple of pins beyond the edge. Keeping a finger on the edge of the mask to prevent it from slipping, the sky may be put in, working right up to and over the edge of the mask, and lifting it up occasionally to see if the tint is deep enough. Here a word of warning may be needed. The mask must be lifted up frequently, for it is surprising what an effect a very little pigment has. If one goes dabbing away until it seems to look right with the mask, it is almost certain to be much too dark. When the sky seems correct, any little touches of light can be taken out with a piece of plastic rubber, the

pigment in this state coming away very cleanly and easily.—"Phot.," Jan. 6, 1914, p. 16.

Clouds in Bromoil Prints.—C. H. Hewitt indicates, by reference to a series of examples (reproduced), the methods of chief service in adding clouds when pigmenting Bromoil prints. These are :—

1. Leaving the cloud or clouds, and working the sky round them.

2. Laying an even tone, and removing the pigment, so as to reproduce the lights, either by hopping or by other means.

3. Laying a tone and allowing it to dry, and then removing it as required by means of rubber or other abrasive.

Obviously all three methods may be used in conjunction, and this is what most usually happens in actual work.

The first method has the advantage of leaving the light tones of a mass of sunlit cloud a purer white than it is possible to get by any method of hopping off the pigment. The blue sky can be worked up to the crisp edges of the cloud more readily, and a cleaner edge obtained than by hopping.

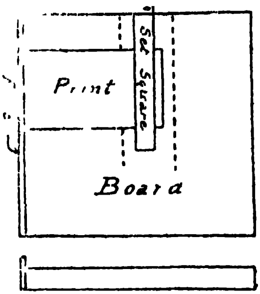
The third method is seldom satisfactory for clearly defined cloud masses, because it only provides the light portions and leaves no method of introducing the shadow side of a cloud. It is also apt to produce a different texture from that obtained by the stippling, dragging, or hopping actions of the brush. If the print is on smooth paper, the rubber gives a smoother, less granular texture; and if on a rough paper, then a more granular one, because it rubs the pigment from the tops of the surface roughnesses of the paper.—"A.P.," Feb. 2, 1914, p. 110.

Platinum Printing.

Brown Tones on Satista Paper.—In the use of this new platinum-silver paper, introduced during 1914 by the Platinotype Company, B. H. Rolfe finds that a pleasing brown tone is readily obtained by bleaching and sulphiding, as customary with bromide prints. It is obvious that the coldest tones will be obtained by developing the original print cold (60° F.) and sulphiding the *dried* print, which has been previously washed and freed from hypo. This would ensure both platinum and silver sulphide images retaining their coldest tones and producing a mixture of black and sepia—a fairly warm black. On the other hand, the warmest final result, an excellent sepia, is effected if the print is developed hot (170° F.), thereby "warming" the platinum as much as possible, and, after washing free from thiosulphates, by transferring direct (without intermediary drying) to the bleaching solution. This should ensure a fairly light-coloured sulphide image in the silver portion. The washing between bleaching and sulphiding should in any case be as brief as possible. On theoretical grounds, sulphiding should add to the permanency of the print.—"A.P.," June 1, 1914, p. 520.

Trimming and Mounting Prints.

A Convenient Trimming Board.—H. Pratt describes a convenient form of trimming board suitable for trimming prints of a wide range of size and shape. It consists of a planed piece of hard wood from half-an inch to an inch thick, the sides being at true right angles with each other. Along one edge is tacked a piece of wood, the top edge of which is about half an inch above the top of the board. The print is placed on the top of the board, with one edge square against this fillet of wood. A set square placed at the top of the trimming board will then allow of the print being accurately trimmed off. Lines can be drawn vertically on the trimming board, as shown by the dotted lines, so as to allow any number of prints to be trimmed to a uniform size.—"Phot.," February 17, 1914.



Cutting and Bevelling Mounts.—G. H. Strong gives the following directions for cutting bevelled cut-out mounts and bevelling the outside edges of mounts:—The tools required are few—viz., a steel straight-edge (one edge bevelled), a piece of plate glass (the larger the better) or a strip, say 9 ins. wide, would do, a narrow oilstone, rule, set-square, and mount knife.

The last-named is the all-important factor in the case, and if there is a secret in mount cutting it is in the blade. Nothing is so annoying after spending some minutes sharpening to have it turn in as many seconds.

Blades should be Grisard's, Paris. When sending them to be ground the tool-dealer should be instructed to give them a long bevel, and care must be taken to keep them specially for the purpose.

A mount is required, say, 12 x 10 sight, 16 x 14 outside. Get a suitable piece of board (six-sheet is mostly used), and with the aid of the set-square mark and cut the outside, using the steel rule for a guide Then mark off 2 ins. all round—again with square and steel—pencil the opening.

Next place the steel straight-edge (with the bevel facing the left) about $\frac{1}{8}$ in. outside the square to be cut (or, if preferable, allow the $\frac{1}{8}$ in. when marking the 2 ins.), and cut through line. With the knife held between the thumb and first two fingers, and holding the guide firmly with the left hand, insert the blade at the farther point, drawing the knife towards the body. Obviously if a bevel is required the handle must be tilted, as there is a tendency for the knife to run inside the line. It is essential that a keen edge is kept, and then the board will be cut without resistance.

Having cut the four sides in this manner, lift the whole, and with a sharp tap at the back of centre the interior will be removed.

If imperfect the inaccuracies may be remedied by reversing the knife as in outside bevelling.

Bevelling Outside Edges.—With the mount the knife has been used on the left-hand side of the steel, but it is difficult to cut, say, ¼ in. or less in this way in order to obtain an outside bevel. The photograph is placed face upwards, the steel (with the champhered edge facing the right) resting on it.

Always remember to give plenty of tilt both ways to the blade, proceeding with a dragging cut rather than a tear. It is not at all necessary to get through at one stroke, providing that the straightedge and photograph are held firmly in the meanwhile.

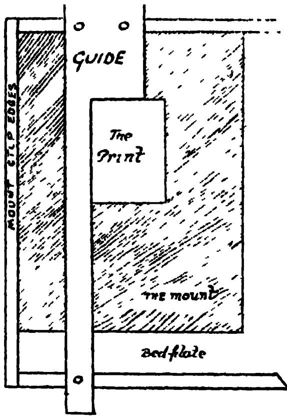
Oval, circle and shaped mounts are usually cut without a guide, and some little practice is required. An oval should never be started at its small end, as the commencement of the cut is always seen, and the long sides are the more easily trued up.—"B.J.," April 17, 1914, p. 305.

Two Mountants Which Keep.—Two formulæ for mounting pastes which can be made up readily and will keep for a reasonable time (a year or more) are as follows:—Soften 200 grains of any good gelatine and soak for an hour or so in cold water. Then take 2½ ozs. of rice starch and mix with cold water to the consistency of cream; make up to 20 ozs. with water; add the gelatine and apply gentle heat, continuously stirring until the mixture becomes thick and glassy in appearance, then add two or three drops of oil of cloves and allow to cool before putting into jam or pickle jars, preferably the latter, with patent airtight tops, for storage. It is ready for use at once, and the prints to which it is applied are not likely to curl up at the edges.

If you should be in the habit of using paper of double or postcard thickness, perhaps the following recipe will be found to be a very useful one:—Take 4 ozs. of the best Scotch glue and allow it to soften in 15 ozs. of cold water for not less than twelve hours (twenty-four will not hurt); then apply moderate heat until the glue is thoroughly melted and the solution becomes clear, add 65 ozs. of boiling water, stirring meanwhile. In another vessel 30 ozs. of stiff starch paste are stirred up with 20 ozs. of cold water until a thin milky fluid without lumps is obtained. Into this the boiling glue is poured with constant stirring and the whole kept at boiling temperature for ten or fifteen minutes. After cooling, ten drops of carbolic acid should be added to the paste, which will be found to be of extraordinary adhesive power, and will hold not only prints, but card or millboard, or even wood.—"B.J.," June 12, 1914, p. 460.

Covers for Fish-Glue Bottles.—A convenient "cork" for bottles containing gum, fish-glue, and similar adhesives is a piece of the thin sheet rubber used by dentists and known as "rubber dam." This is stretched tightly over the mouth of the bottle and held in around the neck with a strong rubber band. The rubber, of course, gradually "perishes," but a fresh piece lasts at least a year, and its cost is trifling.—"B.J.," Dec 19, 1913, p. 982.

Dry-Mounting Prints in Quantity.—R. R. Rawkins describes a convenient accessory for facilitating the rapid fixing of the print in correct position upon the mount where a considerable number of prints, all of the same size, have to be mounted on boards, all also of the same size. The purpose of the device is that the adjustment at the start can be made by an experienced mounter, and the prints then fixed in position correctly by unskilled labour. The accessory consists of a wooden board or bed-plate, provided with raised edges on three sides about ⅛-in. thick. A guide is cut out



of 8-sheet cardboard, and is fixed in position, as shown in the drawing, so that the print, when pushed into the angle of the guide, comes exactly in position on the mount, which, in turn, has only to be pushed into the angle of the bed-plate. By means of this device the work of placing the print correctly on the mount is reduced to two very simple operations. The guide can be set to different positions when dealing with different batches of prints. —"B.J.," June 12, 1914, p. 452.

Dry-Mounting Failures.—A defect sometimes seen in dry-mounted prints is a line of mounting tissue showing round the print, or if not all round, along one or two sides. This may be due to bad trimming, but it is much more likely to occur through the print not being dry and to its contraction under the heat of the plate and before the softened shellac tissue has had time to cement the print securely to the mount. If the heat of the plate is too great another difficulty will occur at the same time, the melting of the gelatine surface, assuming that a bromide, carbon, or a P.O.P. print is being mounted. To obviate these difficulties it is best to straighten out the prints as taken down from the drying racks, when the moisture in the print from the slightly moist air is sufficient to prevent

the gelatine surface from cracking. Then they may be laid together in a warm, dry place, not tightly pressed, which would prevent perfect drying, nor yet laid loosely, when they would again curl up and be troublesome. An hour or two should be sufficient to ensure complete dryness, and so with care in the use of the thermometer for gauging the temperature of the hot plate, neither of the defects we have referred to should be seen in the mounted prints. —"B.J.," January 2, 1914, p. 2.

Mounting Large Prints.—A very good method of mounting enlargements of size 24 x 18 and upwards, is the following recommended by G. T. Harris :—A smooth board suitable to the size of the print, or a clean table-top, receives the print face down, the corners of the print being fixed to it by ordinary dark-room pins. A solution of the best glue, of about the consistency of cream, is sparingly applied with an ordinary house-painter's brush, and worked thoroughly all over the print. The desirable object is not a thick coating of glue, but an infinitesimal film evenly applied all over, and to ensure this the coating, having been evenly applied, must be worked with the brush until practically every brush mark has disappeared and only an even tacky surface remains. The print is now laid down upon the mount, and, with the palm of the hand or a clean cloth, smoothed into contact with the mount by working from the centre to the edge radially in all directions. Once the print is in contact all over the mount and free from any trace of air-bells, it can be finished by going over the surface with an ivory or bone burnisher, a piece of mounting-board being laid upon the print to prevent friction marks from the burnisher. The temperature of the mounting-room in winter should be attended to, or the glue will set before the print is ready for laying down —"B.J.," March 27, 1914, p. 244.

Stain for Frames.—G. T. Harris finds that diamidophenol, as used for development, makes an excellent and pleasing stain for woodwork, and one which, so far as is shown by two or three years' experience, is permanent. The stain is made up, without any particular formula, by adding enough diamidophenol to a 20 per cent. solution of soda carbonate to turn it a dark brown. This mixture is applied to the wood with a brush. Depth of colour is got by several applications, and when thoroughly dry, oiling with boiled linseed oil increases the depth and richness.—"B.J.," March 20, 1914, p. 214.

Stain for Oak Frames.—G. E. H. G. recommends using, for the staining of oak frames, ordinary Brunswick black mixed with plenty of good turpentine. The mixture is applied to the frame with a broad, flat brush. The black in its pure state dries quickly a glossy brownish black, and when diluted makes a very good "light" or "dark" oak, and dries with a very faint oily sheen which brings out the full beauty of the grain of the wood.—"B.J.," Feb. 13, 1914, p. 131.

Brown Stain for Oak Frames.—H. E. Till recommends the following method for securing a range of browns from straw colour to

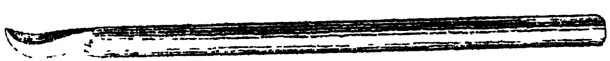
deep walnut on oak frames. The stain is found to be permanent. The materials are Vandyke brown crystals and washing soda. The former are not sold by every drysalter, though obtainable at the larger colour stores, but can be had from firms such as Messrs. Cashmore, Victoria Street, Bristol. The powder Vandyke brown is not suitable, as it clogs the grain of the wood and destroys the pattern. To make the stain, mix 2 to 3 ozs. of Vandyke brown crystals with a handful of washing soda. Place in a saucepan, with half-gallon of water, bring to the boil and continue boiling until thoroughly dissolved. The mixture is then bottled for use. It can be mixed with further water according to the depth of colour required. If applied hot it sinks more deeply into the wood, though it is quite efficient when used cold. The stain should be well rubbed into the wood with a short bristle brush. If desired, the stained frame, when dry, can be well rubbed over with a little linseed oil, which gives a semi-polish and imparts a lustre to the colour — "B J.," Jan. 30, 1914, p. 94.

Working Up Photographs.

Relief Photographs.—A. C. Glover describes a mechanical method of obtaining photographs showing almost any required degree of relief.

The necessary materials are —A print on a thin, tough paper (thick paper and those with thick emulsions—as glossy gelatine papers—are not suitable, as they are apt to crack); some strong adhesive, such as fish glue; lead foil, the kind used for putting on damp walls previous to papering; and a modelling tool.

This latter can be easily made at home from a wooden meat skewer or similar article. The one most useful is of the following shape :—



If home-made, particular care should be taken in smoothing it on fine glass-paper, as a rough corner would probably tear through the lead and show on the print Two other necessary things are carbon paper (the blue pen-carbon is best) and a velvet pad. Two or three thicknesses of velvet is sufficient—the focussing cloth folded a few times answers admirably.

Take a piece of lead a little larger than the print and coat it *evenly and thoroughly* with the fish glue When slightly tacky—*i e.*, when very slightly dried—place the *dry* print on, and carefully rub down with a soft rag rolled into a ball until it is thoroughly in contact all over.

It is safer to put it under pressure for a time to ensure its proper adherence. Afterwards allow to dry *thoroughly*. This is absolutely essential, as if not properly dry when the other operations are commenced it will probably leave the support or break.

When thoroughly dry place the whole thing face up, with the carbon paper underneath, next to lead surface, on a hard support,

such as a piece of glass. Over the face of the print place a sheet of transparent paper; a transparent gardee envelope cut open is the best, being strong. Then go over the outlines and all the shadows with a blunt pointed instrument, such as an agate stylus. This has to be carefully done, as the success of the whole thing depends on getting the true outline of features and shadows. For a broad mass of shadow rub lightly all over

When finished turn the photograph round, and the back of lead will have the figure, etc., outlined in blue. Now turn the print *face down* on the velvet pad, and *gradually* press out the lead *from the back, between the lines*, using the modelling tool. For most of the work the rounded spoon-back end is best, using the other end for high lights or draping, etc , and small details. Special tools can be made for special work. The print should be turned up occasionally to see the effect, but care must be taken not to bend the lead or the whole work may be ruined. Be careful not to make a false mark, as it cannot be taken out. It is remarkable how much relief can be obtained, and it can be modelled to suit each individual taste. Portraits against dark backgrounds, with the face fully lighted, make the best "relievos" When finished the hollows at back should be filled up with plaster of Paris to prevent the work getting damaged. In the mounting and framing there is ample room for individuality. If carefully done the finished picture is most effective, and something which the cheap man cannot very well imitate - "B.J," July 31, 1914, p. 596.

Grain of Matt Varnish.—Dr. Lüppo Cramer has published some interesting photo-micrographs of the grain of ground-glass varnish

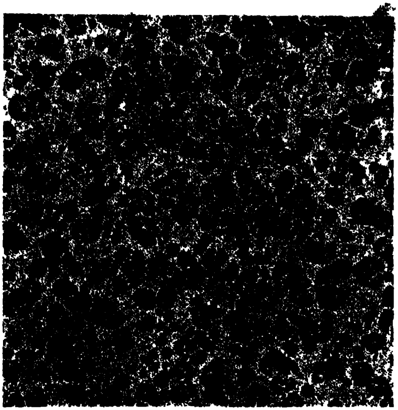


Fig. 1.

prepared by dissolving sandarac in a mixture of ether and benzole. The basis of such matt varnishes is, of course, the use of two liquids,

in one of which alone the resin is not soluble. On evaporation the more volatile ether escapes first, after which the benzole preponderates, and the resin is precipitated in a more or less finely

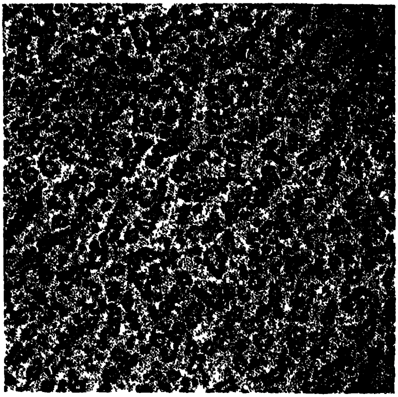


FIG. 2.

divided state. A formula in common use is:—Ether, 192 c.c.s.; sandarac, 18 gms.; mastic, 4 gms.; benzole, 70 c.c s. Dr. Cramer has now, for the first time, we believe, published photo-micrographs

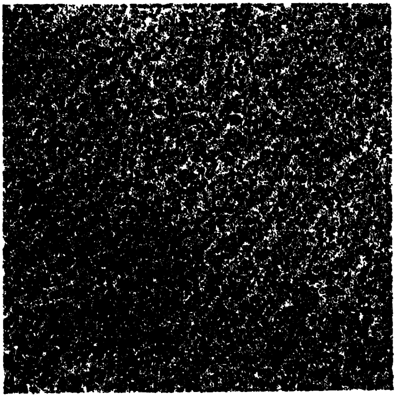


FIG. 3.

of the grain so produced. The reproductions are 100 diameter enlargements. Fig. 1 shows the grain produced by the formula given above. By adding more ether the grain is rendered finer. Fig. 2

is a reproduction of the grain obtained by a further addition of ether to the extent of one part to each six parts of the varnish. Fig. 3 shows the still finer grain obtained on adding ether in twice this proportion. Addition of benzole causes a coarser grain. Fig. 4

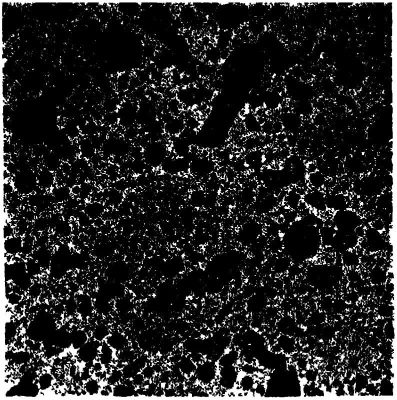


Fig. 4

shows the result of diluting six parts of the solution made according to formula with one part benzole.—"Phot. Rund," Heft 15, 1913 "B.J.," Nov. 7, 1913, p. 859.

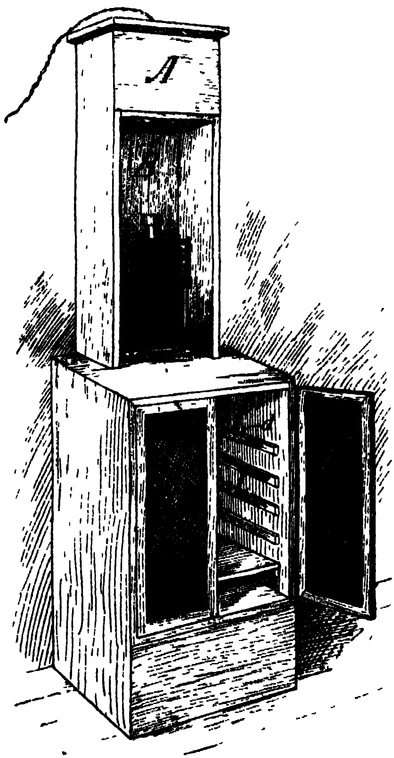
Cleaning Photographs.—The Actien Gesellschaft fur Anilin Fabrikation have patented the use, in cleaning or restoring oil paintings, photographs, etc., of certain organic bodies, such as, for instance, benzyl alcohol, benzyl benzoate, ethyl benzoate, chlorhydrin, glycerine acetates, ethyl oleate, dimethyl phthalate. Such bodies may be used not only for cleaning or restoring oil paintings, but also in like manner with advantage for the treatment of frescoes, aquarelles, stereo-chromes, pictures painted with casein colours or *in tempera* (colours mixed with albumen solution or gelatine solution as a binding agent) and photographs.—Eng. Pat. No. 17,531, 1913. "B.J.," Apr. 14, 1914, p. 309.

Enlarging.

Enlarging Scratched Negatives.—When enlarging from film negatives a good deal of trouble may be saved when dealing with batches of amateurs' negatives, which are liable to show scratches, by coating the negative with a weak solution of fish-glue or Seccotine. This should be worked down with water until it will spread easily with a soft brush, but will not run; and a coating of this will dry glossy and even, levelling up most of the scratches, while it can be as easily removed when the work is done.—"B.J.," Apr 24, 1914, p. 326.

Avoiding Retouching Showing in Enlargements.—"Caractacus" finds that the greatest help is obtained in eliminating retouching by varnishing the negative after retouching. Retouching *on* the varnish shows worse than any. The retouching does not always absolutely disappear, but the varnish softens it very greatly. It takes the sharpness off the lines; scratches on the negative will, if not very bad, entirely disappear, and knife-work becomes transparent, whereas without the varnish it will often be quite opaque. Of course, varnishing means time and expense, but when one considers how much is saved in the finishing it will be seen to be more economical in the end.—"B.J.," Apr. 10, 1914, p. 288

Vertical Enlarger.—H. Bamford describes a home-made enlarger of this type, in which the source of light is a 200 c.p. Osram lamp, used without a condenser. The lamp is mounted in a box, A, measuring 11 x 11 x 13 ins., the interior sides being lined with pieces of plate mirror. The whole of the top of the box is covered with white card as a further reflector and diffuser of the light, whilst the bottom carries the negative carrier, which is covered with bluish tracing cloth. The combined action of mirrors and diffusing cloth is to yield a very even light over the negative (half-plate). The whole box is mounted on an open frame, B, of 3ft. height, on the floor of which rests an ordinary camera fitted with 8¼-in. lens. The bottom of frame B is open, whilst an aperture is cut in the top of the cupboard, C, of size to permit of camera making a light-tight joint on it. The cupboard measures 4 ft. high by 2 ft. 6 ins. wide by 22 ins. deep, and is fitted with strips, *d*, allowing of the flat shelf (easel) being placed at various heights.—"B.J.," July 24, 1914, p. 571.



One-Exposure Enlarging.—M. G. Cromer has elaborated a system of exposure in enlarging according to which the same exposure is given whatever the scale of enlargement or density of the negative. This result is secured by greater or less diaphragmming of the source of light which thus requires to be one of considerable intensity, and is used at its greatest power for the highest degree of enlargement. M. Cromer gives the calculations for adjusting the apertures of the diaphragms to the degrees of enlargement.—"Bull. Soc. Fr. Phot.," July, 1914, p. 212. "B.J.," September 25, 1914, p. 725.

Lantern Slides.

Cleaning Lantern Slides.—S. W. Searle points out the advantage of using methylated spirit instead of water for cleaning finished and bound lantern-slides, as is necessary in their regular use. The spirit, used in a few drops on a duster, cleans off the dirt instantly; the glass does not require the same amount of polishing, and the binding strip is not loosened as it is when water is used.—"Phot.," Apr. 21, 1914.

Transferring Proofs to Celluloid.—In making slides for lantern projection, or where for any reason it is desired to transfer to a flat celluloid surface a printed proof—such, for instance, as an illustration from a book, magazine, or newspaper—a process recently made public in Germany is very simple and effective. The surface to which the proof is to be transferred is rubbed gently for about two minutes with a rag or a ball of cotton wool dipped in alcohol. For this purpose the ordinary "denatured" alcohol, if colourless, is just as good as the pure, and much cheaper. The proof to be transferred is then promptly laid face downward on a plate, and pressed firmly thereon for about fifteen seconds—for instance, in a copying press—several thicknesses of paper being put below the celluloid and over the proof, to equalise the pressure. The result is that all the lines of the engraving are transferred, naturally left-handed, to the softened surface of the celluloid. The paper must be withdrawn before the celluloid hardens. Should, however, the softened surface harden too quickly, the paper may be removed by rubbing with a wet sponge; the impression of the picture will not be injured. Fresh proofs transfer more readily than old ones; but even the oldest printed lines will leave the paper and adhere to the partly dissolved celluloid.—"B.J." (from "Scientific American"), June 26, 1914, p. 505.

Masking Lantern-Slides.—S. L. Saul recommends ruling the borders of the picture on a lantern-slide with an ordinary draughtsman's ruling pen, using Indian ink, and lines as broad as the pen will give without trouble. It is then very easy to lay on gummed masking strips up to these broad lines. As a T-square and parallel ruler can be used, there is no doubt about getting the opening truly square.—"Phot.," June 30, 1914.

Cinematography.

(Space will not permit of reference to the numerous patents for cinematograph cameras, projectors, and films for animated photography in monochrome and natural colours. The specifications are published or abstracted in "The British Journal of Photography," and entered in the annual index of that publication under (1) Cinematographs and (2) Name of Patentee.)

VI.—COLOUR PHOTOGRAPHY.

Patents for Colour Photography.—The chronology of the patent specifications relating to colour photography commenced in the monthly "Colour Photography," Supplement to the "British Journal of Photography," Jan. 4, 1907, is concluded with the issue of Dec. 6, 1907, p 96. All current patents are dealt with week by week in the "British Journal of Photography," and are entered in the annual index under (1) Colour photography and (2) Name of patentee.

The Three-Colour Process.

One-Exposure Colour Cameras.—A. E. Conrady and A. Hamburger have patented a construction of one-exposure camera in which the distortion produced by reflector filters is corrected by suitable distortion of the filters themselves by application of pressures at points around the edges. Eng. Pat. No. 28,722, 1912.—"B.J.," Feb. 6, 1914, p. 106.

A. Dawson has patented a one-exposure camera for three-colour photography in which the correction, or elimination, of distortion, due to the transparent filters, is effected by interposing, between the lens and the sensitive plates, transparent elements of curved surface. The form of the curved surfaces will in each case depend upon certain variable quantities, such as the thickness, form and angle of inclination of the transmitting reflecting elements, the focal length of the lens, cruciform arrangement, etc., and the curvature may be circular, elliptical, parabolic, or hyperbolic in form, or any combination of these forms.—Eng. Pat. No. 24,538, 1912. "B.J.," Mar. 13, 1914, p. 200.

Three-Colour Prints.—The Hess-Ives Company have patented a process for the making of three-colour prints through negatives taken through the usual three filters. Dye carriers are made by exposing transparent celluloid sheets coated with bichromated gelatine under negatives, the uncoated side being placed next to the negative. After exposure the unaffected gelatine is dissolved away, as in ordinary carbon printing. These reliefs or dye carriers are immersed in appropriate dye solutions, and successively impressed upon a sheet

of paper which has been coated with mordanted and hardened gelatine. To prevent smudging or staining while registering the successive images various methods of temporarily insulating are proposed, such as registering while the dyed relief is dry and damping the back of the print paper, fixing relief and paper in separate frames, which can be held a small distance apart, or allowing a film of insulating liquid to run between the two surfaces. Registration may also be effected by mechanical means, as in ordinary letterpress or lithographic work. Methods of protecting or fixing the complete print by means of varnish or a hardening bath are given, many dyes being fixed with a solution composed of water, 30 ozs.; No. 8 acetic acid, 1 oz.; tannic acid, 15 grs.; alum, 75 grs.; acetate of calcium, 10 grs. In order to be able to use a very strong dye-bath and yet to control its action, a solution-assisting salt may be used, such as citrate of potash. Certain dyes are indicated for use, and diagrams of apparatus for facilitating the transfer of the colours from the dye carriers to the paper are given. Eng. Pat No. 15,283, 1913. "B.J.," August 21, 1914, p. 653.

F. E Ives has likewise patented a full process for the preparation of three-colour prints by assemblage of three monochrome impressions obtained as dye images by staining relief positives obtained by printing on celluloid coated with bichromated colloid. The specification contains full details of the dyes and operations employed. Eng. Pat, No. 17,799, 1913. "B.J.," September 4, 1914, p. 679.

Fish-glue Process for Colour Transparencies.—A. E. Bawtree has published full working details of the method of printing devised by him, in which the image is formed by one or several dyes. The stages of the process are:—

1. Coating glass plate with bichromated fish-glue.
2. Exposure under the negative
3. Development in cold water.
4. Dyeing-up in colour solution
5. Varnishing, if plate is to be re-sensitised for further printings from the same or other negatives.

The sensitising solution consists of:—

Fish-glue, Le Page's clarified	2 ozs
Ammonium bichromate 10 per cent. solution.	1 oz. (fl.)
Water	4 ozs.

This keeps in good working order for about two months. During the second month its sensitiveness becomes about double.

The negative requires to be one of two tones—*i.e.*, opaque dots (or ground) and transparent portions—that is to say, a process plate and hydroquinone developer are suitable means for making the negative Plates should be backed, and general veil from any cause avoided. Old gelatine negatives are suitable for coating, clearing off the emulsion film with 3 per cent. hydrofluoric acid solution immediately before using. The glass is then well scrubbed with a paste of Tripoli powder, whitening, and caustic soda solution. The washed glasses are coated with the sensitiser on a whirler and dried over a gas ring, or, better, in front of a clear fire.

Before placing in contact with the negative the coated plate is well warmed. The film is about twice as sensitive at 80° F. as it is at 40°. It is exposed in a screw-pressure printing frame, the times required at 80° F. to full sunshine being approximately as given by the following table :—

FISH GLUE EXPOSURES.

Time.	May. June. July.	April. August.	March September	February October.	January. November.	December.
11—1	1,1/3	1,1/3	1,2/3	2,1/3	4,2/3	6
10—2	1,1/3	1,1/3	1,2/3	3	6	8
9—3	1,1/3	1,2/3	2,1/3	4	12	18
8½—3½	1,2/3	2	2,2/3	5	—	—
8—4	1,2/3	2,1/3	3	6,2/3	—	—
7½—4½	2	2,2/3	4	8,2/3	—	—
7—5	2,1/3	3	6	—	—	—
6½—5½	2,2/3	4	—	—	—	—
6—6	3	6	—	—	—	—
5½—6½	4	—	—	—	—	—
5—7	6	—	—	—	—	—

The exposures are calculated to the nearest third of a minute in order to use the Warwick time meter, which is divided into these periods.

The exposure under similar conditions to a Westminster enclosed arc lamp, 200 v. alternating, 4½ amp., will be 12 minutes at 12 ins. distance.

In some classes of work, particularly where the negative consists of large clear spaces containing fine lines of deposit, it is advantageous to back the glass plate For this purpose nothing is better than Avery's backing, applied after coating, but before warming. Generally, however, it will be found quite sufficient to place behind the glass in the printing frame a piece of the matt black paper used for wrapping up sensitive dry plates.

Development consists of merely soaking in cold water for half a minute (having previously washed off the backing if such were used), and then rinsing under the tap. A spray nozzle with a fairly strong force of water is a great help for speedy washing. Failing that, a good substitute can be made by attaching a short length of soft rubber tube to the tap and squeezing the end flat, so that the water comes out with force as a fan. All operations after the first half minute's soaking can be carried out in full daylight

The next operation is that of dyeing the developed image. The colours obtainable can be ascertained from the following table :—

Claret	Soluble Blue, 1%	Methyl Violet, 3%	Auramine, 0·3%
Violet	Soluble Blue, 1%	Methyl Violet, 3%	
Deep Blue	Soluble Blue, 1%	Methyl Violet, 3%	Malachite Green, 5%
Blue	Soluble Blue, 5%	Oxalic Acid, 1%	
Peacock Blue	Soluble Blue, 5%	Naphthol Green, 1%	Malachite Green, 5%
Blue Green	Naphthol Green, 1%	Malachite Green, 5%	
Myrtle Green	Brilliant Yellow, 1%	Chrysoidin, 2%	Soluble Blue, 5%
Grass Green	Brilliant Yellow, 1%	Chrysoidin, 2%	Malachite Green, 5%
Yellow Green	Naphthol Green, 1%	Malachite Green, 5%	Auramine, 0·3%
Lemon	Aurantia, 2%	Auramine, 0·3%	
Orange	Brilliant Yellow, 1%	Acridine, 1%	
Deep Orange	Brilliant Yellow, 1%	Chrysoidin, 2%	
Brown	Acid Brown, 2%	Bismarck Brown, 2%	
Buff	Rose Bengale, 1%	Auramine, 0·3%	

Orange Red...	Rose Bengale, 10%..	Auramine, 0·3%	
Scarlet........	Rose Bengale, 10%..	Auramine, 0·3%	Rose Bengale, 10%
Deep Red	Dye scarlet and then use Chrysoidin, 2%		
Pink..........	Rose Bengale, 10%..		
Grey	After exposure dust the undeveloped print thoroughly with plumbago powder applied with a soft brush, the adhesion being assisted by breathing on the plate. Then develop as usual, but apply no dyes.		
Warm Grey	[illegible]		
Green Grey .	Tint Grey as above, then dye lightly glass green.		
Blue Grey	Tint Grey as above, then dye lightly blue, omitting the oxalic acid.		

A still larger variety of colours can be obtained by printing an image in one colour and then re-sensitising the plate, printing from the same negative upon it in exact register with the first image and dyeing this second print with another colour. For example, a very good cold shade of green is obtained by an image in brown superimposed upon one in blue-green, and an indigo blue by superimposing an image in blue-green upon one in pink. This opens up a field for experimenting which promises very interesting results. For this work in some cases the one fish-glue print may be put direct upon the other without any insulating medium, but in others the liquid glue has the power of dissolving the colour out of the first print, where any amount of washing in water has not. In other cases the dyeing operations for the second print react with the colour already imparted to the first film, causing great uncertainty as to the final effect. Experiment alone can determine when insulation is necessary or not.

When the duplicate printing is employed for obtaining certain colours, and insulating is necessary, and whenever successive printings from different negatives are to go down in order to produce a multi-colour transparency, the first printing must be covered up with a varnish which requires to be colourless and transparent, impervious to the dye solutions, and capable of holding the fish-glue image, even when heated, as on exposure or during exhibition in the projection lantern. It is found that two varnished coatings are necessary to secure these qualities

The first consists of ordinary cyclist's rubber solution thinned down with benzole or coal tar naphtha to about the consistency of cream. The perfectly dried plate is coated with this, flowed over from one corner and assisted over the surface of the plate, if necessary, with a strip of paper. The plate is then slowly whirled, say, at the rate of 120 revolutions per minute for half a minute. It is then placed in front of a fire or stove and allowed to remain as hot as can be comfortably borne by the hand for about half an hour. Failing a suitable source of heat, it will dry equally well if allowed to stand exposed to the air, but not to dust, for about twelve hours. If the solvents in the rubber are not completely dried out before the next coating there is risk of the latter stripping or frilling off.

The second varnish consists merely of Mawson's enamel collodion. This is poured on at one corner and flowed across the plate by careful tilting, the excess being drained off into a separate bottle. Sufficient must have been applied to obviate the use of a guiding strip of paper, and a little practice will be found necessary before it is possible to

pour an even film free from ridges. The secret lies in never letting any other than the pouring-off corner be the lowest one, and in rocking the plate from side to side while tilting. As soon as the plate has ceased to drip it may be stood in front of the stove to bake dry, which operation will only take about ten minutes. The operation can be much hastened by laying the coated plate flat on the table as soon as the film is set and setting light to the spirits it contains. This is all right for work where there has not been much labour put into the plate, but as there is a distinct possibility of the glass cracking, it is not to be recommended with valuable plates.

Re-sensitising for the second coating is done by merely pouring a pool of sensitive glue on to the plate affixed to the whirler, the lip of which should be wetted, guiding the liquid over the surface with a glass rod or strip of paper, and then whirling as before. The plate is dried by heat in the ordinary way.

Some of the dyes, particularly chrysoidin, are readily dissolved by the solvent in the collodion. Where these appear in a transparency they should be made the last printing, or else the coating with the rubber solution should be repeated before applying the collodion.

The process may be used for colour prints on paper as well as for colour transparencies. For this purpose the well-cleaned glass is thoroughly dried with a clean cloth. It is then wiped over with a soft rag and French chalk, the excess being lightly dusted off. The margin of the glass is smeared round for a width of about one-quarter of an inch with the rubber solution, applied with a scrap of rag. The glass is next coated with the enamel collodion and allowed to dry. The various printings are carried out successively upon this collodionised glass. When completed, the film has a piece of thin paper mounted on to it with warm 10 per cent. gelatine solution for preference. If a few drops of a saturated solution of thymol in alcohol are added to this gelatine mountant it will keep almost indefinitely. When nearly dry, the paper and film are cut through well inside the rubbered edge of the glass, when, upon completion of the drying, the whole print will usually strip off of itself, or, in any case, can be easily removed if the corner is started with the point of a knife.—"B J." Colour Supplement, Nov. 7, p. 41, and Dec. 5, p. 48, 1913.

Raydex Colour Prints on Paper.—C. Welborne Piper, in an article on the practical working of this process, writes as follows:—

In brief, the Raydex process is as follows:—Bromide prints are made from the three negatives, and by Ozobrome methods a colour print is prepared from each one, the temporary support used for the development of each colour print being transparent celluloid. The developed colour images are then transferred to a paper support. The correct superposition of them is quite easy, and this completes the process.

Going into the matter more in detail, we begin by preparing three negatives on panchromatic plates, taking one through a blue filter, one through a green filter, and the last through a red one. The resulting negatives respectively form the yellow, red, and blue printers, and should be marked accordingly. The three negatives, or, better

still, the prints made from them, can readily be identified without the aid of any marks, for, while the blue printer which was made through the red filter will show strong over-correction, the yellow printer made through the blue filter will show obvious under-correction. The red printer, which was made through the green filter, is the only one to show fairly true monotone rendering of the subject, and, naturally, this negative, and the print from it, will be the only one out of the three that will look quite right. The correctness of exposure and development is therefore best judged from it alone, for neither of the other two will look quite satisfactory. Clean plucky negatives suited to the carbon process must be aimed at, thin foggy ones being useless.

The bromide prints must all receive the same exposure, the correct exposure being judged by the red printer which was taken through the green screen. The prints must not be over-exposed, exposure being so regulated that development can be carried to a finish without overdoing it. One very essential precaution is to cut the bromide paper the same way up for each print, so that the paper fibres may all run the same way If this precaution is omitted there will be trouble later, for it will be impossible to secure perfect registration.

Making the Colour Prints.

When the bromide prints are quite finished each is put to soak in water while the colour sheets are prepared. The instructions state that the colour sheets should be wetted with a sponge on the backs until they become limp, but this was found to be a rather slow and unsatisfactory process, and, after some trials, it was found best to soak them in a dish of water, provided they were taken out of the water directly they uncurled. The moment they are limp they are drained and transferred to the special solution supplied by the Raydex Company After two minutes' immersion, they are taken out, dipped in a dish of clean water, so as to remove the superfluous solution, and are then brought into contact under water with the bromide prints. Each colour sheet is, of course, dealt with separately and applied to its own proper print. Thus, if the yellow one is taken first, it is brought into contact with the yellow printer, and the two are then lifted out of the water together on a sheet of glass and squeegeed together with a flat squeegee. The two papers are then lifted off the glass and superficially dried back and front with a cloth or blotting-paper, and are then put on one side for twenty minutes. The necessary safe edge essential in all "carbon" methods is secured by using a colour sheet that is larger than the bromide print. It is necessary to have a good margin all around, otherwise frilling will subsequently be a cause of trouble.

The transparent celluloid temporary supports are prepared by carefully waxing each one all over with a special waxing solution. Care should be taken to wax each sheet thoroughly all over, otherwise the after-transferring process may give difficulty by the prints sticking to the celluloid. At the same time the wax should be well polished off again, as an excess left anywhere may lead to frilling in the hot development. The supports should be prepared at least half-an-hour before they are wanted, so that the wax may harden perfectly.

When the bromide prints and colour sheets have been left in contact for twenty minutes, the two are pulled apart, the bleached bromide being put to wash under the tap while the colour sheet is squeegeed down on to a celluloid sheet. A roller squeegee should be used for this, but it must not be used too heavily. After ten minutes, the celluloid and the adhering colour sheet are immersed in water at 110° F., and as soon as colour is observed oozing at the edges the paper is pulled off and thrown away. The colour print is then developed as a carbon print until all soluble colour is washed away. It will be seen that up to this point we have been simply working the ozobrome process, using celluloid instead of paper as the support

Superimposing the Colour Prints.

The colour image on the celluloid is, of course, the right way round, and when transferred to paper it will be reversed as regards rights and lefts. We must therefore consider here whether to use the single transfer or the double transfer process to get the final result. In many cases, such as those of flower studies, the former will be good enough, reversal being of no consequence, but in others the double transfer will be essential. It is necessary to consider the point because we have not only to determine whether single transfer paper or a final support is to be used, but also to decide the order in which the coloured images are to be superimposed. In the final result the yellow must come underneath the others; therefore, if using the single transfer process, we transfer the yellow image first to the paper, while, if double transfer is intended, the yellow image must be the last one put on the temporary support, so that it will come underneath on the final support. The published instructions have an unfortunate discrepancy in regard to the order of the three colours, for while in the single transfer process yellow, blue, red is the order given, yet yellow, red, blue is the series prescribed for double transfer. The results here described have all been produced by the second process, and in the order given, and, while very fairly satisfactory, they tend to show a slight excess of blue and a deficiency of red. With red as the top colour the effect might have been more nearly perfect. While on the subject of the order of transposition it may be as well to point out that in the double transfer process the image on the temporary support having the yellow on top shows a great excess of that colour, and therefore the truth of the result cannot be judged until the three images are reversed on the final support, so that the yellow comes on its proper place underneath.

The Transferring Process.

The process of transferring the images from the celluloid to the paper support is effected by soaking both in water, then bringing the two together and squeegeeing. Water being removed by blotting paper, the print is put aside to dry, and, when perfectly dry, the paper and celluloid can be separated without difficulty, leaving the image on the paper and the celluloid quite clean. It is better to pull the celluloid away from the paper by bending it

rather than to pull the paper away from the celluloid, for the latter process tends to crack the image on the paper and sometimes to damage it. If the celluloid was properly waxed and the print is bone-dry, there is no difficulty in the separating process. The wax from the celluloid remains on the transferred print, and must be cleaned off before proceeding further, as it will prevent the superimposed images from adhering. The cleansing is carried out with benzole applied with a wad of cotton-wool, and it is important to do it thoroughly. The same piece of wool must not be used over and over again, but fresh wool should be taken repeatedly. It is best to use three pieces, each with fresh benzole, for each print, to make sure that all wax is removed.

In addition to removing the wax from the print already transferred, the next one to be transferred, which is still on its celluloid support, must be prepared with an adhesive, which is supplied under the name of "combining solution." This is spread over the image with a brush, care being taken to cover it completely. The adhesive is then allowed to dry before proceeding further. When dry, we proceed as before, soaking the paper print and also the film on the celluloid, bringing them together under water, then raising them and squeegeeing, adjusting the two in exact register before squeegeeing. When quite dry the celluloid is stripped off as before, and, after repeating the former operations of preparation, the last colour print is applied to the other two. If the single transfer process is being employed the work is now complete, but if a temporary support has been used we have yet to transfer to the final support. To effect this the print and the support are both soaked in water, the former having first been cleaned from the wax. As soon as the final support is limp, the two are brought together under water, lifted out, and squeegeed, then put between blotting-paper and left under a weight for about fifteen minutes. The two are next placed on glass and put into hot water at about 110° F. until the temporary support lifts easily. The print is then washed and dried. This is an outline of the process, full details with regard to solutions being given in the instructions, and there are only two kinds of trouble likely to bother the beginner. The first is frilling and the second difficulty in registering the three prints. In either case the trouble is due to the operator, and very simple precautions will prevent it.

Frilling Troubles.

Frilling of the colour print on the celluloid may be due to leaving too much wax on the support or to lack of safe edge, the latter being provided by using colour sheets larger than the bromide prints. The celluloid should also be larger than the colour sheets, otherwise the film may overlap the edges and then trouble will be met with in the transfer process. Frilling of the superimposed colour prints may be met with in the hot water used for the final transfer, if each colour print has not been thoroughly cleaned from wax. The importance of this cleaning operation has already been dwelt upon. It is obvious that economy demands the trimming of the bromide prints before preparing the colour prints.

REGISTRATION TROUBLES.

Paper prints, when soaked, expand. If all are not fully soaked, or are soaked for different times, or at different temperatures, they may expand unequally; while if the papers are not cut the same way—that is, so that the paper fibres run in the same direction—they will certainly expand unequally in different directions. Paper may also be stretched by too hard squeegeeing or by rough manipulation in the registering process. Care must therefore be taken to avoid rough treatment of either description. The registration should be got as exactly as possible under water, and the last adjustment made by sliding the celluloid over the print, the latter lying on a flat surface. When things go wrong, separate, re-soak, and start again, but do not try to remedy matters by force, which tends to strain the moist paper. With small prints registration is a comparatively easy matter if the precautions mentioned are observed, and with big prints the chief cause of trouble is too rough handling of the paper Such difficulties only require quite ordinary care to avoid, and the process of making the colour print from the three negatives can be quite fairly described as easy, though the intervals that have to elapse between the several operations prevent it from being a very quick one.—"B.J." Colour Supplement, Feb. 6, 1914, p. 5.

In developing the Raydex print on to its final support by the double-transfer process John Brand finds the following method an improvement on that recommended in the instructions, as it lessens the chance of frilling from undue moisture. First, well wash the temporary support carrying the three tissues for five minutes or so; then allow the surface water to drain off by hanging from a clip. Select a glass larger than the final support, dip the final support under water quickly, withdraw, and place on the glass support film side up; then at once place the temporary support holding the three colours on to the final support, squeegee into contact, and place between blotting-paper under a weight for fifteen minutes, and then proceed according to the instructions.

Care should be taken that the benzole used for the removal of the wax from the print answers to the tests of the British Pharmacopœia, as considerable trouble and serious loss is caused by using a benzine which on analysis showed the presence of some impurity which defeated the removal of the wax by substituting an oily surface to the print, thereby preventing it adhering closely to the colour tissue on the celluloid support. The prints refused to leave the supports, and when coaxed with heat did so, but were badly blistered. Petrol may be used with successful results.—"B.J." Colour Supplement, Mar. 6, 1914, p. 9.

Further notes on the practical working of the Raydex process are given by H. W. Canning Wright.—"B.J." Colour Supplement, Jan. 2, 1914, p. 1.

Polychromide Colour Photography on Paper.—A description is given in the "B.J." Colour Supplement of the process which is

worked commercially under this name by Mr. Aron Hamburger, of the Dover Street Studios. The exposure is made instantaneously by flashlight. A large chamber, provided with exhaust for the magnesium smoke, contains three separate flash pans, the powder in which is ignited simultaneously with the opening of the shutter on the camera by a special electric device, which, from the repeated use we saw made of it, is evidently most certain in action. The chamber contains a multi-arc lamp, which is used in focussing and arranging the sitter. [Since the above was written the flashlight has been replaced by 8 2,000 c.p. half-watt lamps.] The camera, with which the three exposures are made simultaneously, is scarcely larger than an ordinary studio model, but is fitted with a transparent mirror so that the three negatives are obtained at one exposure. The red-sensitive plate is in one dark-slide whilst the blue and green-sensitive are placed film to film and exposed together in a second dark-slide. Special emulsions for the three colour-sensations are used, and we learnt that the sensitiveness is obtained in the emulsion, as coated, without bathing. The three negatives are developed and the component colour impressions made from them by methods which have been specially worked out. For the red print an image is prepared by a bichromate process and developed on glass. For the blue and yellow images, bromide prints are made and toned to the standard colours, the blue being a highly transparent image resembling Prussian blue, and the yellow consisting, we learnt, of a silver iodo-chromate. These component prints are assembled very quickly and with the utmost perfection of register. The process has permitted of a finished print being completed in four hours, but fifteen hours is an ample time for running off a small batch of the prints.—"B.J" Colour Supplement, Feb 6, 1914, p. 8.

Three-Colour Carbon Prints from Autochromes.—Achille Carrara gives the following working details of the process found by him to yield three-colour reproductions of Autochromes on paper which are equal in brilliancy and colour rendering to the originals.

The first thing to obtain is a satisfactory set of three-colour negatives from the original Autochrome. These are made by contact in the following manner:—The source of light is one filament of a Radax Nernst lamp. The Autochrome is placed in an ordinary Lumière Autochrome reproducing box, in contact with a Wratten Panchromatic plate. To the front of the Lumière reproduction box (after removal of its shutter and yellow filter) is fixed a Thornton-Pickard studio shutter, which enables one to give accurate time exposures as necessary. In front of this shutter is placed a set of 1⅝-in. square sharp-cut analysis filters, for Nernst light. Between the filters and the light-source is interposed a sheet of fine ground glass (a fixed-out matt-emulsion gelatine plate, a Paget matt transparency plate, will do). The distance of lamp filament from face of analysis filters is about 5 ins.

An exposure is then made through the red filter. An ordinary density Autochrome gives a good negative with 30 seconds exposure. The green and blue filters require each three times the exposure for the red filter, viz., 90 seconds.

The negatives are developed all three together in the same dish, if possible, with Rodinal 1 in 22 for 5 minutes, which gives a soft, delicate negative. In some cases a negative with a little more vigour in it is better, especially for carbon printing, and this is easily obtained by slightly increasing the time of development with the addition of a few drops of 10 per cent. bromide solution to the developer if necessary

The negatives are all very good and clear In the yellow-printing negative (blue filter) the granular structure of the Autochrome plate is very marked, but it has no importance whatever in the printing process, as this granular structure will be absolutely invisible.

In the red-printing negative (green filter) the Autochrome granular structure is much less marked and the red prints are very smooth and clear

The blue-printing negative (red filter) is the one to give us trouble, as the granular structure comes out very marked, and in superimposing the blue print on the yellow and red prints the granular structure of the blue print is much too evident.

A softening of the general granular structure on all three plates was necessary to begin with, and this was easily obtained without the loss of any detail in the negatives by interposing a border mask of notepaper between the Autochrome film and the panchromatic plate before making the exposures This had the desired effect of greatly softening the granular structure on the resulting negatives.

As a further aid to reduction of grain it is well to interpose a thin sheet of celluloid between the blue-sensation negative and the blue tissue when printing, and this has the desired effect of practically nullifying most of its obtrusive granular structure.

For printing the three negatives use the Autotype three-colour tissues Sensitising is done with a quick-drying sensitiser (see under "Carbon Printing")

It will be found that the average strength of the bath will be 4 per cent. for the red tissue and 3 per cent for the blue and yellow tissues for printing portraits in the sun, as the red tissue is required to cover more of the high-lights in the flesh tints than the yellow or blue However, the question of strength of sensitising baths is one to be adjusted for each set of negatives

It is best to print in the sun, and to use a Watkins exposure meter and stop-watch for timing exposures Once these are fixed for a set of negatives, prints from it can be made at any time without difficulty

In the case of a portrait with dark background of green foliage the printing data are:—

Blue tissue 3% spirit bath printing ratio, 8½ times Watkins' standard meter tints.

Red tissue 4% spirit bath: printing ratio, 6 times Watkins' standard meter tints.

Yellow tissue 3% spirit bath printing ratio, 5 times Watkins' standard meter tints

Considering that the average time for the darkening of Watkins Steadfast paper in sunlight is about 5 seconds, these exposures for the tissue work out to:—

Blue	$6 \times 8\frac{1}{2} =$	51 seconds.
Red	$6 \times 6 =$	36 ,,
Yellow	$6 \times 5 =$	30 ,,

And therefore 1 minute's good sunlight is sufficient to print a set of negatives.

As temporary support, celluloid waxed with Vanguard's "Glissolene" is excellent in all respects. As cementing medium between the three films a 5 per cent. solution of hard gelatine in water is used, and applied as cold as possible to the paper print laid flat on a piece of glass or opal, gently lowering on to its gelatine-solution-covered surface the next film to be superimposed on its celluloid temporary support.

A few drops of carbolic acid will allow the gelatine solution to be kept in use for some time and used repeatedly.

Benzole cleans the wax off the surface of the prints after stripping the celluloid, and a ten minutes' immersion of the finished print in a 10 per cent. solution of alum serves to harden and render insoluble the cementing gelatine.—"B J." Colour Supplement, March 6, 1914, p. 10.

Quick-Drying Sensitiser for Three-Colour Carbon Tissue.—See under "Carbon Process," Section V.

Simplified Pinatype.—Dr. E. Konig describes a method of working the Pinatype process, which forms a simplification of this means of producing three-colour prints. The colour-sensation negatives are made in the customary way. From each of these a print is made on transparent film coated with suitable bichromated gelatine, the exposure being made through the film. The films are developed in warm water and dyed up with the corresponding dyes—namely, Pinatype blue F, Pinatype red F, and Pinatype yellow F, of Meister Lucius. The colour images thus obtained are transferred by contact to paper exactly as in the old Pinatype process. It will be understood that the method is applicable also to other Pinatype dyes and to monochrome work for prints in various colours. Monochrome prints of excellent quality may be prepared in this way. No doubt many who have experienced difficulty in the working of the Pinatype process may be inclined to give the new method a trial. Apart from the simplified manipulation, the method is stated to possess certain advantages, affording a better rendering of detail, a finer range of colours and much less heaviness of the shadows, compared with the older process.—"Phot. Rund.," Heft 21, 1913, p. 325; "B.J." Colour Supplement, May 1, 1914, p. 20.

Colour Prints from Autochromes.—M. F. Ungener has patented a process of preparing three-colour prints from Autochrome and other screen-plate transparencies. Three separate negatives are made by contact through the usual filters. These are printed as follows:—In the first place the back of the baryta gelatine paper is coated with a solution of 3 per cent. gelatine, to which a small quantity of chrome alum has been added, so as to make sure that

it will stretch only to the smallest possible extent. After being dried the paper is laid in cold water, and kept there for about one minute until the gelatine layer is thoroughly softened. The paper is then laid on a piece of plate glass and pressed lightly with a roller on the coated side to remove superfluous water. The wet sheets are then laid on a drawing-board which has been covered with paper, and are fixed at the four corners. The sheets are now to be coated with the sensitising solution, as used for the ferro-prussiate or blue process, *e.g.*, (1) 50 c.c.s. distilled water, 4·5 gms. red prussiate of potash; (2) 50 c.c.s. distilled water, 12·5 gms. green ammoniated citrate of iron.

Of these solutions equal parts are taken and mixed together. About 25 c.c.s. will suffice for four sheets of paper of 18 to 24 sq. c.m. The sheets, after coating, are dried as quickly as possible, and then printed under the red-filter negative until the darkest shadows approach a bright grey-blue. The print is then washed and dried. The thoroughly dried prints are then laid for about 8-10 minutes in a tray with "zapon lac" to render them perfectly impenetrable to water, and they are then dried again. Meanwhile two solutions are prepared for the subsequent coating of the prints. One solution consists of 68 gms. of American fish glue dissolved in 100 c.c.s. water, whilst the other consists of 6 gms. of dry egg albumen dissolved in 75 c.c.s. of water. After the albumen is properly dissolved, 8 gms. of bichromate of ammonia are added.

The two solutions are then mixed, and finally 7·5 c.c.s. of a 10 per cent. solution of chromic acid are added, and the whole is filtered repeatedly. This forms a stock solution which will keep for about fourteen days.

A small quantity of the stock solution, about 100 c.c.s., is then taken and diluted with 50 c.c.s. of water to form a solution for immediate use. The prints are meanwhile secured to a small hand whirler and repeatedly coated with the last-mentioned solution and then dried by means of the whirler over a small flame.

The blue filter negative is then taken, on which the blue print can very easily be fitted exactly, and exposed to bright sunlight or other suitable actinic light for a short time. The print is then laid for about a quarter of an hour in cold water, and thereafter placed in a tray containing the following yellow solution:—2 gms. aurophenin (Hochst) dissolved in 100 c.c.s. hot distilled water. This solution is then made up to 1 litre with distilled water, and 200 c.c.s. alcohol, 96 per cent., are added.

The print is placed in this solution, being kept in constant movement, and allowed to remain—being frequently examined and rinsed—until the yellow of the print has acquired the right shade and the green, too, partially appears in the right shade. The print is then washed and well dried, and 2 per cent. collodion poured over it. After the layer of collodion has dried a second coating of the fish glue solution above described is given to the print; then it is placed under the green-filter negative, exposed, washed, and laid in the red bath, which consists of:—

10-12 c.c.s. of a 3 per cent. solution of erythrosin (Hochst) dissolved in 100 c.c.s. water.

After sufficient saturation, when the red colour of the picture has appeared correctly, the print is slightly washed and then put into a 5 per cent. solution of sulphate of copper for about two minutes, washed again, and dried. The picture is then complete. It should be observed that the tinting with the colouring material is completed in a few minutes in each instance, whilst the tinting of separate gelatine films, such as has heretofore been done, occupies from one to ten hours.—Eng. Pat No. 17,979, 1913; "B.J.," Feb. 6, 1914, p. 107.

A Two-Colour Method.—F. W. Donisthorpe has patented a process based on the observation that if a negative which has been exposed through a light-filter of one colour—red, for example—is placed in contact with, and the image super-imposed with a positive transparency from a negative taken through another colour—green, for example—the two pictures exactly counteract each other in all parts which contain no colour—such as blacks, whites, greys, and all shading; that which is black in the negative would be white in the positive, and *vice versâ*, thus viewing through the two images superimposed would give no image at all

When colour is present we get a different effect. Those parts on the red negative are not counterbalanced by the green-sensation positive; for instance, a green object would be white on the red-filtered negative, and also white on the green-filtered positive, and the red objects would be black on both, and other colours tending more to green or more to red would come out more or less black on one or the other of the images. The result is that a print taken through the combined negative and positive will have the colouring matter only in black and white, everything else having been counteracted by the two images cutting each other out

The prints taken through the two superimposed images will give the red parts as pure white, the greens as pure black, and the between colours as darker or lighter greys. Now if we take this print and place it in a bath which will tone it green, and at the same time render the silver image impermeable to aqueous dyes, and then place it in a red dye bath, we get the blacks of the image toned green and the whites red, the greys a little of green and a little of red, a combination which gives grey. The darker and lighter shades in the toned print take more or less red dye according to the colour of the photographed objects, giving more greenish or more reddish shades. This turns the print back into the colours which were originally filtered through the two light-filters: in other words, it gives a representation of the colouring matter only. Now, if such prints are placed in contact and superimposed with black and white positives taken from red and green filtered negatives, we get the whole picture in natural colours—the green and red print giving the colouring matter, and the other the blacks, whites, and shadings —Eng. Pat. No. 7,368, 1913; "B.J.," June 26, 1914, p. 503.

One-plate Three-colour Processes.

PROCESSES OF PREPARING SCREEN-PLATES.

Under this heading are described processes the products of which at the time of writing (Sept., 1914) are not on the market.— ED., "B.J.A."

Recessed Colour Screen-Plates.—L. Dufay has patented an improvement in the screen-plate, described in "B.J.A.," 1914, p. 695. Instead of packing the grooves on one of the sides of the celluloid with a greasy homogeneous material dyed in one of the three colours of the screen—for instance, green—according to this invention the greasy material is mixed with perfectly transparent elements of any shape, but of a diameter slightly smaller than the width and depth of the groove to be filled. These elements, before their incorporation into the greasy material, are dyed with a selective colour—for instance, violet. These coloured particles are introduced into the grooves or other recesses, and only the interstices of the groove which were left free are filled with homogeneous greasy material, which will alternate with the coloured particles in the groove.—Eng. Pat. No. 27,708, 1912; "B.J.," Dec. 5, 1913, p. 939.

Screen-Plate Colour Prints.—R. Ruth and A. Schuller have patented a method of preparing a plate, which consists in dyeing each colour element with two dyes of the same colour but of different natures, one of which can be removed after the picture has been taken; the dyes being chosen so that the two sets of dyes together make a screen sufficiently deep for taking the picture, while the set of dyes which remains after the removal of the other set form a screen sufficiently light to produce a satisfactory picture with a paper or other white opaque backing in contact therewith.

The patent specification gives the names of dyes suitable for use with starch grains or with resin, as also of dyes suitable for applying the process on the bleach-out system.—Eng. Pat. No. 22,451, 1912; "B.J.," Oct. 24, 1913, p. 823.

SCREEN-PLATES ON THE MARKET.

THE LUMIERE AUTOCHROME.

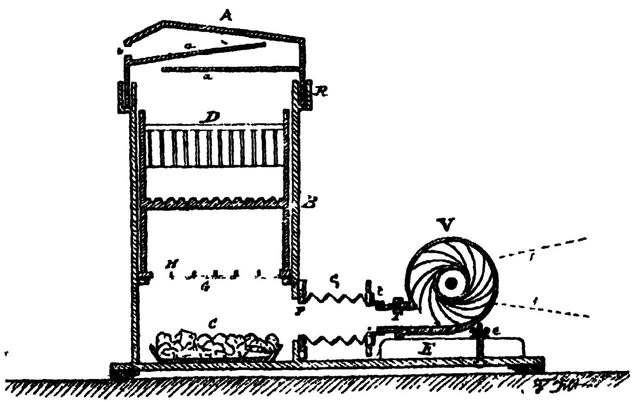
Extra-Sensitising of Autochrome Plates.—F. Monpillard points out that old hyper-sensitising solutions cannot be made to give good results by increasing the time of immersion of the plates. In such an old bath the greater part of the pinacyanol becomes inactive, and thus the plate is made more sensitive to yellow and green, but not to red.

For hyper-sensitising, therefore, a fresh solution should always be used. If need be, it can be made up some time in advance. In this solution several plates may be treated simultaneously or successively; but after use it should be unhesitatingly rejected. The time of immersion may vary within wide limits, but should never be less than three minutes.

The degree of dilution employed may also be varied, but it is preferable to keep to that which experience has shown to be the most favourable, namely, one part of the hyper-sensitising liquid to ten parts of the bath, including one part of ammonia solution. A greater dilution necessitates a longer immersion, and that it is best to avoid. In spite of the precautions taken in manufacture, Autochrome plates may contain minute holes in the film of gelatine, and the longer a plate with such a defect is left in contact with liquid the greater is the chance that the liquid may make its way through into the screen-plate coating, and produce stains.

Experience has shown that provided that the dilution and time of immersion remain the same, the results obtained by hyper-sensitising do not appreciably vary for differences in temperature from 46° to 60° Fahr. (8° to 16° C.).—"Phot.," Jan. 20, 1914, p. 49.

Drying Box for Hyper-Sensitised Plates.—M. F. Monpillard has described a simple form of drying box designed by M. L. Gimpel for the rapid drying of Autochrome plates after extra sensitising by bathing. A small centrifugal fan V is driven by an electric motor, and conveys a current of air into the wooden chamber B. which latter is closed above by a cover, which is light-trapped by the plates *a a*, and rests in a groove, R, the whole forming a light-



tight joint, but one readily admitting of the egress of air. In its lower portion the box B has a lateral opening formed by a board, P, a bellows, S, and a flexible tube, *t*, which is connected with the delivery tube T of the fan. The fan itself is affixed to a base, E, which, by means of a nut and wing bolt, can be conveniently fixed in position to be driven by the motor. Immediately opposite the lower opening of the box is placed a dish containing a plentiful supply (C) of calcium chloride.

Above the dish of chloride is placed a light frame, to the edges of which are glued a couple of thicknesses of gauze, for the purpose of catching any dust, although in practice it is found that particles of dust are arrested by the calcium chloride, which becomes slightly damp immediately on the fan beginning to work. On the edges of a grid, H, is placed a wooden rack, D, provided with grooves, which allow of the customary sizes of plates being readily stacked.

The apparatus has been most successfully employed in drying Autochrome plates. After draining the hyper-sensitising solution slowly away from the tank in which the plates are treated, the latter then dry in ten minutes. In the case of ordinary gelatine plates the drying takes from forty to fifty minutes, in consequence of the much greater thickness of the gelatine film.—"Bull. Soc. Fr. Phot., June, 1914, p. 184; "B J." Colour Supplement, Sept. 4, 1914, p. 36

Light-Filter for Hyper-Sensitised Autochromes—F. J Hargreaves finds that Autochromes made with the extra-sensitised plates have sometimes a general greenish hue, more especially marked in the shadows and on neutral tinted parts of the subject. The effect is more likely to show itself when using the last portions of a bottle of dye-sensitiser. A preventive of it is the use of the Wratten K1 light-filter in place of the light greenish-yellow screen of MM. Lumière. It may sometimes happen in the regular use of the K1 screen for extra-sensitised Autochromes that a pinkish tint is produced, but, in portraiture particularly, such predominant colour is greatly preferable to the greenish tint.—"Phot.," Oct. 21, 1913, p. 350.

Focussing Screens for Colour Plates.—F. J. Hargreaves recommends the use, as a focussing screen, of an unused plate of the same make that is being exposed. In this way the "grain" of the selecting screen is superposed, as it were, on the focussed image, and the limitations imposed are thereby thus forced on one's attention during focussing. The bare screen without the emulsion will be found too transparent for convenient use, and a coating of matt varnish or a very fine ground-glass bound in contact with the screen will be an improvement. A better way is to fog an unused plate, and develop, fix, and bleach it with mercuric chloride, as has been suggested for an ordinary plate. A very dilute developer should be used and the plate fixed as soon as, by transmitted light, it is visibly darker. The whole operation can be done in daylight if a developer such as rodinal 1 in 100 is used. When the plate is dry it should be varnished and covered as usual, and mounted in the screen frame with its glass surface in the same register as the glass surfaces of the plates in the dark slides.

This brings to notice the additional advantage that since the screen is one of the actual plates in use, absolute register is automatically obtained. This is very far from being the case with ground-glass screens, which vary much in thickness. The fact is of great importance, as large apertures are naturally the rule in screen-plate work.

It will be found that the colours appear slightly brighter on such a screen than on a ground-glass screen—in fact, very much like an over-developed or over-intensified screen plate—but as the colours are usually judged by looking at the actual scene, this is no disadvantage.—"Phot.," Mar. 17, 1914, p 221.

Metol-Hydroquinone Developer.—For subjects containing much green and grey, or where there is little contrast, A Brizet finds that the following developer serves well:—

Water, hot distilled	250 c.c.s.
Metol	1.5 gm.
Hydroquinone . . .	1 gm.
Soda sulphite anhydrous	10 gms.
Potass bromide .. .	C6 gms

After cooling, and when all the chemicals have been dissolved, add

Ammonia, 22 deg . .	3.2 c c s.

This developer contains a relatively large proportion of metol and hydroquinone, but it should be borne in mind that metoquinone is a combination 30 per cent. more active than the mixture of two parts of metol and one part of hydroquinone. The developer is used like metoquinone, but in double the quantity, *e.g.*, for 7 x 5 plate take 80 c.c.s. of water and 40 instead of 20 c.c.s. of developer. The developer, made as above, will not fog the plates; the latter can be developed for as long as six minutes.—"Photo-Revue," April 12, 1914, p. 113; "B.J.," Colour Supplement, April 12, 1914, p. 19.

Chloranol Developer for Autochromes.—M. V. Cremier recommends the use of Chloranol, the newly invented developer of MM. Lumière, for the development of Autochrome plates, on the ground of its greater solubility and the ease with which a perfectly bright solution can be made. Moreover, Chloranol is twice as soluble in water as metoquinone, and thus is better suited for making concentrated developing baths. It serves for the development of both the positive and negative image, and is stated to be free from the effect of an apparent reduction in vigour of the image on re-development. The formula is—

Hot water	1,000 c.c.s.
Chloranol	15 gms.
Soda sulphite, anhydrous ...	100 gms.
Potassium bromide	6 gms.

After cooling, add:—

Ammonia, 22 degs.	32 c.c.s.

This solution may be filtered, but it is not really necessary to do so.—"Photo-Revue," June 21, 1914, p. 196. "B.J." Colour Supplement, July 3, 1914, p. 26.

Autochrome Formulæ.—A. B. Hitchins gives the following formulæ for the developer, reverser, and de-sensitising solutions, found best for the Autochrome process:—

For the First Development, Solution A.

Water	1,000 c.c.s.
Metol	6·5 gms.
Soda sulphite (anhydrous)	40 gms.
Hydroquinone	2·10 gms.
Potassium bromide	2·5 gms.
Hyposulphite of soda	0·10 gms.
Ammonia, 0.880	20 c c s.

For use, one part developer, one part water. It will be noticed that the above solution contains a minute quantity of a solvent of silver bromide, *i.e.*, hypo. This causes the image to begin reversing in the first developer. Carry on development about four minutes until the high-lights or flesh tones just begin to show reversal and look transparent when viewed against the safe light (a trial or two will soon show just the right time to stop development); rinse for a few seconds under gently running water before reversing.

Reversing Solution B.

Potassium bichromate	4 gms.
Sulphuric acid	15 c c.s.
Water	1,000 c.c.s.

This reversing solution works more cleanly than potassium permanganate, and the action is much more thorough. About three or four minutes is necessary for complete reversal. Flood the plate with solution in the dark-room, and then bring out into a strong light until the action is complete. Rinse for two or three minutes, then re-develop the plate in

Re-developing Solution C

Water	1,000 c.c.s.
Soda sulphite (anhydrous)	21 gms.
Diamidophenol	6 gms.
Potassium bromide, 10 per cent. solution	100 drops.

Complete re-development takes about four minutes, and should be carried out in strong light. The best working temperature for the above solutions is 65° F. Autochromes made by this method will be found much more transparent, and the rendering of flesh tones and light colours is very pure and brilliant.

Another "first developer" that yields wonderfully transparent colours can be made by the addition of ferrocyanide of potassium (not ferri) to the "first developer" formulæ given, in the proportion of one-half of ferrocyanide to the total bulk of reducing agents. Thus in the formulæ given we have 6·5 gms. of metol and 2·10 gms. of hydroquinone, total bulk 8·15 gms., therefore, use 4·07 gms. of ferrocyanide and omit the hypo.

A further simplification is to desensitize the Autochrome plate previous to the first development This may be done with:—

Water	100 c.c.s.
Potassium metabisulphite	5 gms.

Immerse in this in absolute darkness, and in about five minutes the colour sensitiveness of the plate is destroyed, and the first development can be carried out by ordinary orange light.—"Wilson's," Jan., 1914, p. 15; "B.J." Colour Supplement, June 5, 1914, p. 22.

Autochrome Plates in the Tropics.—Professor F. Tobler has recorded his experience in the use of Autochrome plates during a journey in South and East Africa, extending from July, 1912, to April, 1913. Contrary to his expectations he found that the keeping quality of the plates was greater than claimed by the makers. This was his experience in regard to plates kept in the packages, as also those carried in dark-slides. For example, plates purchased from a retail dealer in June, after travelling through the Tropics, were exposed early in September in South Africa with satisfactory results. Others despatched from Europe in January were found to be in perfect condition in September, although the packages directed that they should be exposed before the end of April. In other cases plates were kept for from six to eight weeks in the dark-slides between exposure and development and still rendered normal results. Dr. Tobler states that plates were packed in the customary manner for the Tropics—namely, in metal cases sealed with adhesive plaster. In no instance was it possible to take any special precautions in the way of keeping the plates cool.

As regards development *en route* Dr. Tobler found the Lumière concentrated metoquinone developer in powder carton form very suitable, but he used also the ordinary metol-hydroquinone developer, such as the Agfa cartons, with equally satisfactory results, finding it a matter of convenience to employ one and the same developer for both colour and ordinary plates. As regards the practical development of the exposures his experience was, on the whole, in favour of waiting his opportunity for a fairly low temperature at night to present itself as a result of changes in the weather or arrival in a cooler district. This was found preferable to making use of ice in places where this latter was available; it was found that with every care it was almost impossible, by means of ice, to keep the various solutions at the same temperature. A further excellent means of avoiding the difficulties of development in a hot climate was to postpone the second development and subsequent operations, drying the plate after a brief rinse from the permanganate reversing bath. Dust on the front and back surfaces of the plates was found, even in Egypt, to be less of a difficulty than than was anticipated and never presented itself to an extent which precluded the useful employment of the plates. One point which Dr. Tobler emphasises as particularly calling for care is the protection of the light-filter against excessive exposure to light. He prefers to mount it behind the lens for the sake of the additional protection. His general conclusion is that those travelling in tropical countries should not hesitate to provide themselves with the Autochrome plates; their use demands some additional care, but they are nevertheless extremely valuable in the making of colour pictures and records for scientific purposes.—"Phot. Rund.," Heft 19, 1913, p 297. "B J." Colour Supplement, April 3, 1914, p. 16.

Copying Autochromes.—M. E. Cousin points out the advantage, when preparing duplicates of Autochromes, of making (in the first instance) an Autochrome negative, that is, in complementary colours. In this case, of course, the customary reversing process

and second development are omitted, the plate being simply developed, fixed, and, if necessary, intensified. In thus working from a negative Autochrome, if the colour screen is not exactly balanced as regards the light, the predominant tint which is produced exists in the complementary colour, and in the reproduction process serves as a correcting screen. In short, the predominant tints of the negative and the positive colour transparencies compensate for and tend to extinguish each other. It is obvious that in making the copy it is necessary to use a light of the same character as that with which the original negative was taken.

On the other hand, when working from a positive Autochrome, any predominant tint, due to incomplete adjustment of the light-filter, is added to in the reproduction, and may thus be accentuated to a degree which is very noticeable.—"Bull. Soc. Fr. Phot.," Nov., 1913, p 330; "B.J." Colour Supplement, Feb. 6, 1914, p 7.

Enlarged Negatives from Autochromes—It sometimes happens that one has an Autochrome of exceptional beauty, from which it is desired to make a larger print in monochrome, and for this purpose the Autochrome can be used as the intermediate positive from which an enlarged negative is made. If the enlarged negative is made on an ordinary plate the granular effect of the Autochrome will be very apparent, and to get a smooth negative with this granular effect eliminated one should use an orthochromatic plate with a three times, or preferably five times, screen. This will give an enlarged negative of a fine quality, equivalent to an original negative made with a colour screen, as all the colours of the Autochrome will be represented in the enlargement in their proportional values of black and white.—"B.J." Colour Supplement, Nov. 7, 1913, p. 44, from "Journal of the Photographic Society of Philadelphia."

THE PAGET SCREEN-PLATE.

Paget Screen-Plate Colour Prints.—At the Photographic Arts and Crafts Exhibition, held in London, May 8 to 16, 1914, the Paget Prize Plate Company gave the first public demonstration of the making of screen-plate prints on paper, of which a description appeared in "B.J.A.," 1913, p. 707 The method of registration there described has been further improved. The previous method consisted in the registration of an emulsion-coated Paget viewing screen with a negative obtained in the usual way through the Paget screen-plate. Although the registration in this way in complementary colours was rendered quite practicable by the special device of the Paget Company, the new method obviates it altogether and renders the process also more rapid in manipulation.

A negative is made through the Paget taking screen in the usual way, and from it a print is made on a special paper—namely, one of silvered surface coated with gaslight emulsion. This print is developed and washed in the usual way, and, whilst still in a wet state, is laid upon a glass plate bearing a Paget special viewing screen. It is easily brought into register with the viewing screen provided

it is thoroughly wet. It is then squeegeed into contact and the whole put aside to dry. When dry, the print is readily stripped from the glass with the film of viewing screen firmly adhering to it.

The result is a colour print of characteristic appearance, due to the metallic under-surface. Perhaps a colour print of this kind may be compared with a Daguerreotype *plus* the charm of colour, but it is hardly so sensitive as a Daguerreotype in respect to the angle from which it requires to be viewed. The prints do not yield their full effect when viewed "against the light," but, providing light falls upon them fairly fully, their colour rendering is well seen.—"B J." Colour Supplement, May 1, 1914, p. 20

Binding Paget Colour Transparencies.—Dr. H. D'Arcy Power describes the following method, found by him most convenient, for the binding of Paget transparencies in registration with the screen-plate viewing screen. The two plates are laid and adjusted on a sheet of ground glass placed horizontal and illuminated from below With the plates lying on the glass table, apply to the edge of the plates a little Le Page's glue or Seccotine, just as soon as the registration is complete If the manipulation has put them out of register the error can be instantly corrected, as the glue is still soft, afterwards leaving them until dry, a matter of an hour or so Once the glue sets, they can be bound with binding tape without the least fear of displacement.—"Cam Craft," Mar. 19, 1914, p. 107; "B.J." Colour Supplement, May 1, 1914, p. 17.

Making Paget Colour Transparencies from Autochromes.—Arthur E Morton, in making a series of Paget lantern-slides from Autochromes, places the Autochrome in the back frame of a large camera and behind it a condenser and light-source for its illumination. The Paget panchromatic plate is held in the dark-slide of a smaller camera mounted in a line with the larger one. A Paget colour taking-screen is placed in contact with the film of the panchromatic plate.

A convenient source of light is a Howellite incandescent gas burner, with which, when reducing half-plate Autochromes to lantern-slides with a Ross rapid symmetrical 5-in. lens working at *f*/8, the exposures run from 15 to 60 seconds, according to the density of the Autochrome. A special filter for incandescent gas (obtainable at small cost from the Paget Prize Plate Co., Limited) is necessary. It may be fitted either in front of or behind the lens, or placed in the lens jacket. No light—other than that passing through the lens from the original—must reach the taking-screen and panchromatic plate. The panchromatic plate is developed in 1:30 rodinal at 60° F., about two minutes' development giving a suitable negative. From the negative so obtained a positive transparency is made by contact and bound up in registration with the Paget viewing-screen, according to the customary method. It is well to make the transparencies of somewhat bluish tint to allow for the yellowishness of most projection lights.—"B.J.," Colour Supplement, Dec. 5, 1913, p. 45.

The Bleach-Out Process.

Bleach-Out Dyes.—Dr. A. Just has patented the use of colouring matters of the chinoxalin series, and in particular flavindulin, as dyes for the yellow. They are found to be highly permanent and readily sensitised by means of such substances as anethol, thiosinamine, etc. They are best prepared by the action of orthodiamines on diketones. Flavindulin is sensitised to an even greater speed of bleach-out effect than methylene blue.—Ger. Pat. No. 263,221, of Feb. 13, 1913; "B.J" Colour Supplement, Nov. 7, 1913, p. 44.

Fixing Bleach-Out Prints.—Dr. R. Stahl has patented the treatment of bleach-out colour prints, obtained with dyes which have been sensitised by means of thiosinamine. After the bulk of the sensitiser has been removed by washing with water or alcohol, the residue is decomposed by means of an acid solution of a nitrate. For this purpose the bleach-out print, prepared with a gelatine emulsion, is first soaked in water or weak alcohol and then transferred into an acid solution of sodium nitrate in weak alcohol. In this the thiosinamine is decomposed and the products dissolved out of the film by the alcohol, the print being finally washed. A similar procedure is used in the case of collodion bleach-out prints Any excess of nitrous acid is removed by application of a solution of thiocarbamide, followed by washing. Fixing agents may be added to the desensitising baths.—Ger. Pat. No. 264,492 of July 12, 1912; "B J." Colour Supplement, Nov 7, 1913, p 44

Key to the Abbreviations of Journals quoted in "Epitome of Progress," with Addresses.

"A. P." .. .. "The Amateur Photographer and Photographic News."
Hazell, Watson & Viney, Ltd., 52, Long Acre, London, W.C.

"Amer. Phot" .. "American Photography."
221, Columbus Avenue, Boston, Mass., U.S.A.

"Apollo" .. .. "Apollo."
Albrechtstrasse 39b, Dresden A 10, Germany.

"Atelier" .. .. "Das Atelier."
W. Knapp, Halle a/Saale, Germany.

"Aust. Phot. Journ." .. "Harringtons' Photographic Journal."
Harringtons', Ltd, 380, George Street, Sydney, Australia.

"Aust. Phot. Rev" .. "Australasian Photo-Review."
Kodak (Australasia), Ltd., 379, George Street, Sydney, Australia.

"B. J." .. .. .. "The British Journal of Photography."
Henry Greenwood & Co., Ltd., 24, Wellington Street, Strand, London, W.C.

"B.J.A."	.. ..	"The British Journal Photographic Almanac." Henry Greenwood & Co., Ltd., 24, Wellington Street, Strand, London, W.C.
"Bild" ..	.. ..	"Das Bild." Neue Photographische Gesellschaft, 27, Siemensstrasse, Berlin-Steglitz.
"Bull. Belge" ..	..	"Bulletin de l'Association Belge de Photographie." Ch. Puttemans, Palais du Midi, Brussels.
"Bull. Soc. Fr. Phot."		"Bulletin de la Société Française de Photographie." Gauthier-Villars, Quai des Grands-Augustins 55, Paris, France.
"Bull. Phot." ..	..	"Bulletin of Photography." 210-212, North 13th Street, Philadelphia, U.S.A.
"Cam." ..	..	"The Camera." 210-212, North 13th Street, Philadelphia, U.S.A.
"Cam. Craft" ..	..	"Camera Craft." 413/415, Call Building, San Francisco, Cal., U.S.A.; and 3, Wine Office Court, Fleet Street, London, England
"Cam. Work" ..	..	"Camera Work." Alfred Stieglitz, 1111, Madison Avenue, New York, U.S.A.
"Chem. News"	..	"The Chemical News." E. J. Davey, 16, Newcastle Street, Farringdon Street, London, E.C.
"Chem. Zeit." ..	..	"Chemiker Zeitung." Dr. G. Krause, Cothen (Anhalt), Germany.
"D. Phot. Zeit"	..	"Deutsche Photographen-Zeitung." K. Schwier, Sophien Strasse 4, Weimar, Germany.
"Der Amateur"	..	"Der Amateur." Mondscheingasse 6, Vienna VII, Austria.
"Der Phot." ..	..	"Der Photograph." L. Fernbach, Bunzlau.
"Eder's Jahrbuch"	..	"Jahrbuch für Photographie und Reproduktionstechnik." W. Knapp, Halle a/S., Germany.
"Il Prog. Foto."	..	"Il Progresso Fotografico." R. Namias, 36, Via Settembrini, Milan, Italy.
"Journ. Phot. Soc. Ind."		"Journal of the Photographic Society of India." 40, Chowringhee, Calcutta, India.
"Journ. Roy. Micr. Soc."		"Journal of the Royal Microscopical Society." Williams & Norgate, 14, Henrietta Street, London, W.C.
"Journ. S. C. I."	..	"Journal of the Society of Chemical Industry." Vacher & Sons, Ltd., Westminster House, Great Smith Street, London, S.W.

"Journ. Soc. Arts" .	"Journal of the Royal Society of Arts." G. Bell & Sons, Ltd., York House, Portugal Street, London, W.C.
"Knowledge" ..	"Knowledge." Knowledge Publishing Co., Ltd., 42, Bloomsbury Square, London, W.C.
"Le Phot." ..	"Le Photo Journal." 22, Rue Vurenna, Paris.
"Mon. Phot."..	"Le Moniteur de la Photographie." 17, Rue des Moines, Paris, France.
"Nature" ..	"Nature." Macmillan & Co., Ltd., St. Martin's Street, London, W.C.
"Oest. Phot. Zeit."	"Oesterreichische Photographen Zeitung." Oesterreicher Photographen-Verein, Vienna III/I.
"Opt."	"The Optician." Gutenberg Press, Ltd., 123, 124 & 125, Fleet Street, London, E.C.
"P. M." ..	"The Photo-Miniature." 103, Park Avenue, New York, U.S.A.
"Pharm. Journ."	"The Pharmaceutical Journal" 72, Great Russell Street, London, W.C.
"Phil. Mag." ..	"The Philosophical Magazine." Taylor & Francis, 7½, Red Lion Court, Fleet Street, London, E.C.
"Phil. Trans."	"Philosophical Transactions of the Royal Society." Harrison & Sons, 45, St. Martin's Lane, London, W.C.
"Phot." ..	"Photography and Focus." Iliffe & Sons, Ltd., 20, Tudor Street, London E.C.
"Phot. Chron."	"Photographische Chronik." W. Knapp, Halle a/Saale, Germany.
"Phot. Couleurs"	"La Photographie des Couleurs." 118, Rue d'Assas, Paris.
"Phot. Indus."	"Photographische Industrie." 31, Blücherstr, Berlin S 61, Germany.
"Phot. Journ."	"Journal of the Royal Photographic Society of Great Britain" ("The Photographic Journal"). Harrison & Sons, 45, Pall Mall, London, S.W.
"Phot. Korr."..	"Photographische Korrespondenz." Bäckerstrasse 6, Vienna I, Austria.
"Phot. Kunst"	"Photographische Kunst." Paul Heysestrasse 29/31, Munich, Germany.

"Phot. Rund." .. "Photographische Rundschau."
19, Muhlweg, Halle a/S. Germany.

"Phot. Scraps" .. "Photographic Scraps."
Ilford Ltd., Ilford, London, E.

"Phot. Times" .. "The Photographic Times."
135, West Fourteenth Street, New York, U.S.A.

"Phot. Welt" .. "Photographische Welt."
(M. Eger), 4, Gabelsbergerstrasse, Leipsic, Germany.

"Phot. Woch." .. "Photographisches Wochenblatt."
13A, Genthiner Strasse, Berlin W.

"Photo-Era" .. .. "Photo-Era."
383, Boylston Street, Boston, Mass., U.S.A.

"Photo Gazette" .. "Le Photo Gazette."
1, Rue de Médecis, Paris, France.

"Photo-Revue" .. "Photo-Revue."
118, Rue d'Assas, Paris VI, France.

"Photo-Woche" .. "Photo-Woche."
6, Lietzensee Ufer, Charlottenburg, Berlin.

"Photographie" .. "La Photographie."
118, Rue d'Assas, Paris, France.

"Phys. Rev." .. .. "The Physical Review."
41, North Queen Street, Lancaster, Pa., U.S.A.

"Procédé" .. .. "Le Procédé."
150, Boulevard de Montparnasse, Paris XIV.

"Rev. Trimest." .. "Revue des Travaux de Recherches."
A. Lumière et ses Fils, Lyons.

"Sci. Amer." .. .. "The Scientific American."
Munn & Co., Inc., 361, Broadway, New York, U.S.A.

"Sonne" .. .. "Sonne."
Kaiser-Platz, 18, Wilmersdorf, Berlin.

"Wiener F. Phot. Zeit." "Wiener Freie Photographen Zeitung."
Gustav Walter, Alserstrasse 71, Vienna VIII, Austria.

"Wien. Mitt.".. .. "Wiener Mitteilungen."
Graben 31, Vienna I, Austria.

"Wilson's" .. .. "Wilson's Photographic Magazine."
122, East 25th Street, New York, U.S.A.

"Zeit. für Instr." .. "Zeitschrift für Instrumentenkunde"
Julius Springer, Berlin.

"Zeit. für Repro." .. "Zeitschrift für Reproduktionstechnik."
W. Knapp, Halle a/Saale, Germany.

"Zeit. für Wiss. Phot." "Zeitschrift für Wissenschaftliche Photographie."
J. A. Barth, 16, Dorrienstrasse, Leipsic, Germany.

RECENT NOVELTIES IN APPARATUS.

BY THE EDITOR.

[These notices are confined to apparatus introduced since the publication of the last Almanac In all cases the various articles have come under our personal examination, a rule from which we allow no departure.

The items in this section are indexed in the General Index to Text placed at the end of the volume]

AUTOGRAPHIC KODAK CAMERAS

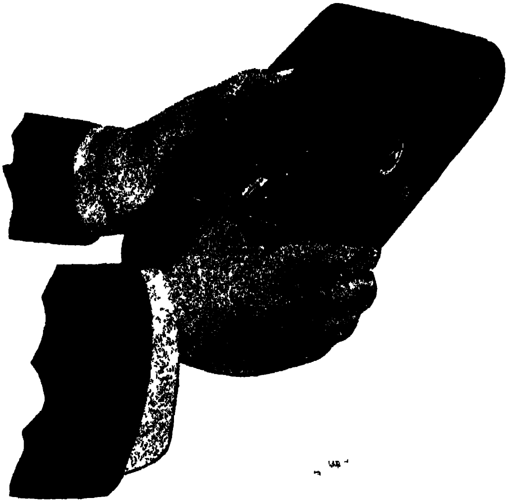
(Made by Kodak, Ltd , Kingsway, London, W C.)

The Autographic Kodak differs from ordinary Kodak film-cameras only in the fact that the back is fitted with a separate panel in which is a narrow slit measuring, in the case of the postcard Kodak which we have used, 3¼ by ¼ in. This slit is fitted with a spring hinged cover within a recess on which is carried a

metal stylus. Except when the device is in use the cover is down, and the stylus is kept in place by a sliding catch. On pulling this catch back the cover springs up, and at the same time the stylus is released and is in readiness for making the inscription upon the film through the aperture. One simply writes in firm up-and-down strokes and then holds the back of the camera up to the light for a time which in ordinary diffused outdoor light will be for from two to five seconds The process is thus a photographic one, de-

pending for its action upon the special form (Autographic) of film cartridge. The latter differs from the ordinary Kodak spool in having between the sensitive film and the enveloping paper a band of paper coated with some opaque material. Pressure of the stylus through the ordinary enveloping band of the spool writes in clear lines on this opaque paper, forming practically a line negative, which, on exposure of the camera-back to light, impresses itself upon the sensitive film and is developed up as black reversed lettering when the spool is developed.

Thus the Autographic method requires the special Autographic spools, which latter are now supplied by Messrs. Kodak at the same price as the old style. The method calls for no extra operation beyond the writing of the inscription within the panel space and the subsequent short exposure to light. Some little care, perhaps, requires to be given in registering the position of each separate exposure in the orange window on the camera back, but



in the course of exposing a six-exposure spool we found that in every instance the inscription came exactly in place on the band of bare film at the end of each section. To every user of a film camera this invention will come as a very real and practical convenience. The fact that with the Autographic method every negative at the moment of its exposure obtains a permanent title is immensely to the advantage of photographers of all descriptions. It is one of those improvements which will certainly encourage the professional view photographer, touring a district for the purpose of making negatives, to avail himself of rollable film for the purpose.

The Autographic back can be supplied to any existing Kodak (of the sizes, viz., quarter-plate, 4¼ by 2½, and postcard, in which the back is at present made) which carries a loose back. The price in this case for the No 3 (quarter-plate) F.P.K. or for the 1A (4¼ by 2½) is 14s. 6d.; 15s. 6d. for the No. 3A (postcard) F.P.K. Where Kodaks are purchased with Autographic backs in place of ordinary ones the increase in price is 10s.

THE "CENTUM" FILM CAMERA

(Made by James H. Sinclair and Co., Ltd., 54, Haymarket, London, S.W)

Despite the great variety of film cameras upon the market, Messrs. Sinclair have devised an instrument which possesses distinct points of novelty and those of a kind which will strongly appeal to the photographic tourist In the first place the camera takes the standard cinematograph film of 1⅜ width, each picture measuring, say, 1¼ x 2⅛ inches The spool reels fitted in the camera take film sufficient for 100 pictures without reloading, whilst the film will be obtainable in daylight spools, and thus the photographic tourist is enabled to take any number of pictures without the necessity of recourse to a dark-room On the other hand, if the tourist is not able to obtain a supply of the spools he can use the ordinary cinematograph negative film, loading it into the camera in the dark-room Messrs Sinclair supply, for a few shillings, a punch with which to make the special perforation required in the film,

In form the camera is of the box pattern, measuring in the working model which we have had the opportunity of examining 6 x 4 x 2¼ inches It is fitted with a lens of about 3 inches focal length, and with a direct-vision finder showing a picture the actual size of that taken in the camera But an essential feature, and one which we are sure users of film cameras will appreciate, is that the film cannot be wound past the proper point to bring a fresh section into position for exposure The winding key is brought to a firm stop, but is freed for a further wind by the operation of the shutter It should be understood that the stoppage of the film is not effected by any tension on the film itself. The perforation is used simply to bring into operation a catch in the winding mechanism, and it is this catch which provides a strong and positive stop for the film The camera is fitted with time and instantaneous shutter giving exposures from ½ to 1-100 of a second, whilst the lens is diaphragmed down by a very simple diaphragm plate likewise operated from the front of the instrument Thus in every respect the camera is of the simplest possible type Its size fits it for carrying in a capacious pocket, or very readily in a sling case The internal mechanism is of the high order distinguishing Messrs Sinclair's specialties The price, with Ross *f*/6·8 "Homocentric" lens, is £10 10s.

THE "VERASCOPE" ROLL HOLDER.

(Made by Jules Richard, 27, New Bond Street, London, W.

In this roll holder, constructed specially for attachment to their Verascope camera, MM Richard make special provision for holding

the film perfectly flat in the focal plane. This they do by providing a thin optically flat glass front within the roll holder. The film travels freely behind this front when winding a fresh exposure, but is instantly pressed firmly against it by turning a metal head on the outside of the camera. Such a provision as this is unquestionably a great advantage in the use of roll film in small cameras such as the Verascope, the negatives taken in which are very gener-

ally enlarged upon a considerable scale. The general construction of the Verascope cameras is of such a high degree of mechanical accuracy that it is gratifying to find that MM. Richard have supplemented their construction by thus providing for a perfectly flat surface of the roll film. In the size to take pictures 107 by 45 mm. the price is £6. The roll holder takes a No. 0 folding pocket Kodak film of twelve exposures, providing six exposures for the Verascope.

THE CUNCTATOR SELF-EXPOSURE ATTACHMENT.

(Made by Jules Richard, 27, New Bond Street, London, W.)

In this very ingenious accessory the user of the Verascope camera is provided with a most simple and certain means of making portraits of himself or of including himself in landscape and other photographs. The device consists of a metal case measuring roughly 2½ by 2 inches, which is simply secured to the Verascope camera by means of a couple of slots. The case contains clockwork mechanism,

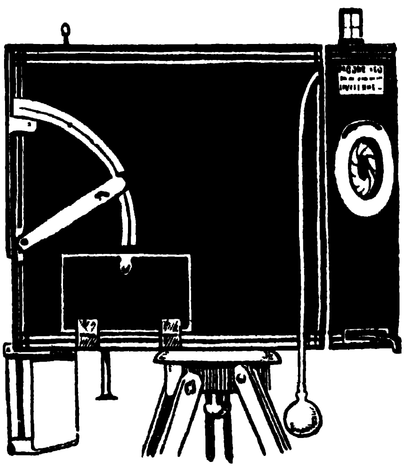
which is wound by pulling over a lever handle, and is started by pushing a stud from one end of a slot to the other. The plate or film being in readiness for exposure in the Verascope camera and the mechanism in the Cunctator being wound, the photographer starts the latter by pushing the stud. The mechanism allows him thirty seconds in which to place himself in the landscape and gives

him three seconds' notice that exposure is about to take place by display of a red patch measuring roughly $2\frac{1}{2}$ by $1\frac{1}{2}$ inches. Three seconds after the display of this patch the shutter of the Verascope is opened for an instantaneous or time exposure according to the setting. In the case of time exposures the Cunctator itself allows of the time being set beforehand for anything from two to sixty seconds Exposure being concluded, the little device signifies the fact to the user by displaying a white sign of similar size to the preceding red one. The instrument embodies the beautiful mechanical work associated with the productions of M. Richard. The price in the model described above is £2. For instantaneous exposures only it is supplied at £1 5s, or for time exposures of from one to thirty seconds, £2 10s.

THE "APTUS" AUTOMATIC FERROTYPE CAMERA.

(Made by Moore and Co 101-103, Dale Street, Liverpool.)

This is a magazine camera for the exposure and daylight-development of ferrotype plates, and embodies quite a number of novel features which make it a most handy and efficient piece of apparatus Although extremely simple in use, it is a little difficult to explain the manipulation of the camera, but the diagram will aid in making this clear if one bears in mind that it is a sectional side view of the



camera. The plates, each measuring $2\frac{1}{2}$ x $1\frac{3}{4}$ inches, are contained in a small metal drawer without a bottom, seen to the left of the drawing. It is provided with a light-tight cover and holds 100 plates. The camera being held level, the drawer is simply pushed in from the side, the cover withdrawn, and a door in the wall of the camera closed. The 100 plates thus lie in a box (without top or bottom)

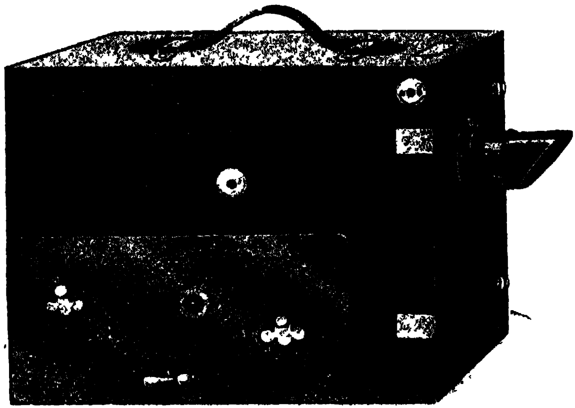
upon the floor of the camera. To bring one plate opposite the lens for exposure two things are done at the same time. The handle on the quadrant outside the camera is turned down into its lowest position. The plunger, seen below the drawer, is raised, and, at the same time, a rubber bulb projecting from the back of the camera is pressed. What happens is that the plunger pushes the top-most plate against a rubber bed attached to a hinged arm, and the plate is held there by suction on releasing pressure on the bulb and allowing the plunger to fall again. On then turning the lever into the upright position on the quadrant the arm bearing the plate is brought back into the position for exposure It sounds a little difficult in description, but we find it to work with the greatest certainty. Exposure is then made by means of the pneumatic release, shown fitted to the front of the camera, the image being sighted through the direct-vision finder (which is provided with a sensible sight aperture), focussing being done by pulling out a lever to the required distance of 2, 3, or 6 yards. Then for development, the bulb at the rear of camera is simply squeezed and causes the plate to drop straight into the developing tank, which is a detachable fitment firmly screwed to the under side of the camera and constructed in two divisions so that plates can be removed from one whilst the other is moved into readiness for a fresh exposure. Messrs Moore supply a magnet with the camera. It serves most conveniently to fish out the plate from the developing tank. The whole apparatus is extremely well made, whilst, as we have said, its novel features make for efficiency in working. The only thing which must be borne in mind is that the camera must be fixed level for use in order to ensure the certain drop of the plate into the developing tank. Plates require about half a minute for a combined operation of development and fixing, are then simply rinsed and ready for placing in a cut-out mount. The price of the apparatus, complete as described, is £3 10s. The plates are supplied at 4s per hundred, and developing powders, making 40 ozs. of solution, at 1s. per set. Cut-out mounts, with gummed paper backs, for holding the ferrotype plate in place are supplied at 1s. 10d. per hundred, or 8s. for 500

THE TRESS CINEMATOGRAPH HAND CAMERA

(Made by the Tress Co., 4, Rathbone Place, London, W.)

Although not ready for the market at the time of the present section of the "Almanac" going to press, it is interesting to report upon a camera for cinematograph work designed and made by the Tress Company and possessing many attractive features. The camera takes the standard cinematograph film, and is provided with two clockwork motors, by which the film is delivered and re-wound entirely by the internal mechanism. It can thus be used in the hand, and many subjects not available when using a tripod can thus be readily dealt with When so desired, however, the winding handle can be used. By a simple device the motor is instantly cut out of action The camera serves also as a projector, and, further, by attachment of a special box, as a printer from the negative

on to the positive film. Such an apparatus as this possesses very great attractions for amateur photographers able to spend the amounts of money which the taking and printing of considerable lengths of film necessarily involve But its use as a camera only specially recommends it to the professional cinematograph operator. At the time of writing the price is not fixed. Enquiries in regard to the camera should be made to the Tress Company.

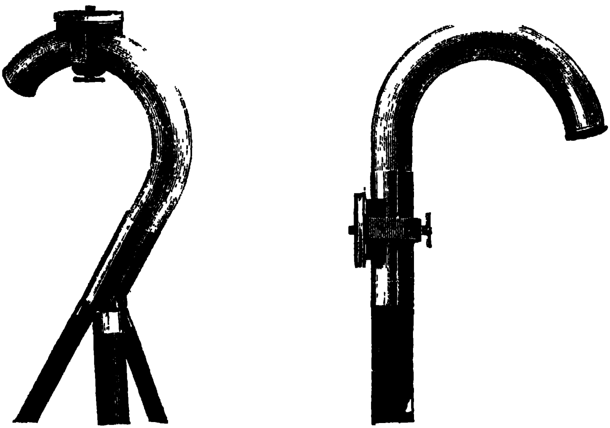


THE "SINCLAIR" WALKING STICK TRIPOD.

(Sold by James A. Sinclair and Co., Ltd., 54, Haymarket, London, S.W.)

This tripod, while not intended to replace those of the ordinary pattern, is nevertheless a very useful accessory for the tourist photographer using a camera of small size. Its form is that of a stout walking stick of 35½ inches length, and fitted with a crook aluminium handle which is capped by a spring lid and can thus be used for holding small articles, such as matches or an "Antinous" release. The legs of the tripod are permanently attached to the handle, two by stout hinges, whilst the third is rigid with the handle. All three of the legs are shod with steel, but the rigid leg is made a little longer so that it forms a firm point for the stick whilst the two hinged legs are relieved from wear and tear when the stick is in ordinary use. A very simple spring catch is used to secure the three parts of the stick together. It is instantly unfixed to open the tripod, whilst, when the latter is closed again, there are no projections. The camera is carried upon a block of 1¾-inch diameter, which is loose on the handle, but can be fixed in any position by a screw clamp. With the stick used for walking it is fixed as shown in fig. 1, whilst for the support of the camera it

is clamped to the handle, as shown in fig. 2, and then serves as a means of adjusting the level of the camera in one direction without altering the position of the legs. The circular head has a wedge-shaped section cut from it, a corresponding piece being supplied with Whitworth or Continental thread for attachment to the camera so that the latter, when fixing it on the tripod, has only to be slid into position without the trouble of fitting a screw into its bush. When erected the tripod has a height of about 3 ft., a rather low position as tripods go, but still one which will often



be of service when the only other alternative is to find some solid support in the way of a fence or post. Used, as it is intended to be, with the operator's body as an aid to the firm position of the tripod, a very rigid support for a small camera is thus obtained. The stand is made in two sizes—namely, that to which we have referred above, and a larger one of 39 inches length when closed. The weights are 19 and 20 ozs., respectively, and the price in each case 21s.

THE "PELICAN" STRIP POSTCARD CUTTER.

Sold by Wahltuch, Smith, and Co., Ltd., 30, Chapel Street, Salford, Manchester

This is a time-saving appliance for the cutting up of 6-postcard strips into the separate cards. This it does at one single stroke. The trimmer consists of a bench measuring 25 by 12½ inches, on which is mounted a series of blocks placed just under 3½ inches apart. To a hinged portion there is attached a similar series of blocks which come into place exactly between those fixed to the bench. To the edges of each block (in both series) cutting edges are firmly attached, with the result that when the postcard strip is laid across the blocks on the bench it is instantly cut into six separate cards on bringing down the hinged series of blocks. A

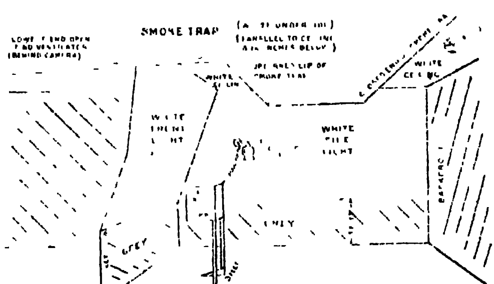
stop is provided for adjusting the strip of postcards in place, and there is also a hinged flap by which the strip is held firmly in place when making the cutting stroke. This strip goes back with the hinged cutting blocks, but is immediately released (by pressing a

spring) when placing the next strip in position The appliance is most strongly made, and its design a thoroughly practical one. It will save the strip printer an enormous amount of time in producing the finished cards. The price is £2 2s.

THE "LAWS" STUDIO FLASH LAMP

(Sold by John J Griffin and Sons, Ltd., Kingsway, London, W C.)

In this lamp the makers employ a magnesium flashlight in conjunction with several inverted incandescent burners The illumina-



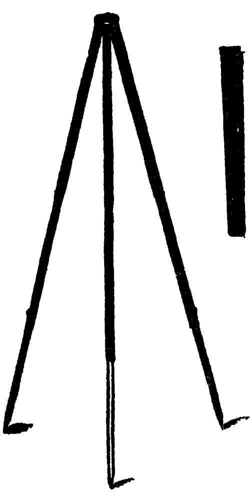
tion is produced entirely by reflected light, the support for the flash pan and the gas burners being screened on two sides so that

no direct light reaches the sitter. The reflectors can be readily fixed in any studio, their size and position depending upon the dimensions and shape of the photographer's working space. The gas burners supply a fairly intense light—sufficient for purposes of focussing and arranging the sitter, but not so powerful that it is necessary to cap the lens in the interval between making all in readiness and igniting the flash Thus the working of the installation is simple : focussing and posing having been done, the lens is left uncapped and exposure made by igniting the flash powder For this a very simple and certain contrivance is used, consisting of a gas flame, the by-pass controlling which is simply operated by pulling a string. For convenience in use the apparatus is made of height 5 ft. 6 ins., and occupies a floor space of 18½ x 18½ ins We have seen the apparatus in use, and also have examined a large number of prints showing the exceedingly soft and pleasant lighting obtained with the lamp. The price of the complete outfit is £5 5s.

THE "IDEAL" ALUMINIUM FOLDING TRIPOD

(Made by J. Ashford and Son, Ltd , Aston Brook Street, Birmingham.)

In this tripod Mr. Ashford, whose experience in the manufacture of tripod supports for the camera goes back for many years, has made a welcome departure. The stand consists of three parts—the two upper of aluminium, and the lower, which slides, of wood. But the aluminium portions are not of the usual tube pattern, but consist of metal of ⊔ section. In opening the stand the lower aluminium part of each leg is extended by turning it over on the pivot by which it is attached (at the lower part) to the upper section. The wood part of the leg is then quickly drawn out, and can be clamped at any point. A great advantage, in our estimation, of this form of construction is that there is no possibility of jamming, such as may take place where aluminium tubes slide one within the other. If by mischance one of the aluminium sections should be dented, it is the easiest thing imaginable to put matters right with a pair of pliers Notwithstanding its extreme lightness —it weighs less than 25 ozs.—the stand is extremely rigid, and an excellent support for cameras of moderate size up to, say,



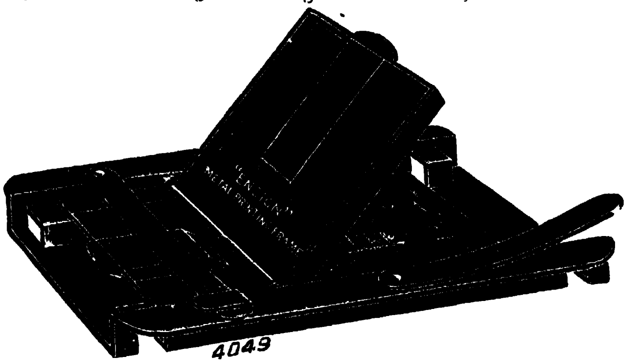
5 x 4 ins In fact, we should have no hesitation in using a larger camera than this, if of light build, upon it. The top, which is felt-covered and measures 2¾ ins. diameter, is fitted with attachment screws of both Whitworth and Continental threads, thus providing for the use of cameras of every make. Fully extended, the tripod

measures 52 ins., permitting the camera to be very comfortably supported at a height of 50 ins from the ground. The price of the stand is 10s. 6d. Folded it measures 23 ins.

METAL AND WOOD PRINTING FRAMES.

(Made by Houghtons, Ltd., 88-89, High Holborn, London, W.C.)

A new type of printing frame of metal throughout is a new introduction of Messrs. Houghtons. The frame is of stout pressed metal, of black non-rusting finish, and fitted with hinged back which gives a view of about two-thirds of the print when examining for progress of printing. In hot, moist climates where wood is apt to warp and joints to come apart there is much to be said for an all-metal frame, while even the home user has often occasion to deplore the breakage of a negative in consequence of the want



of flatness in the rebate of a printing frame. The machine-made metal frame avoids both of these drawbacks. Price, quarter-plate, 7d., and postcard, 1s., inclusive of glass.

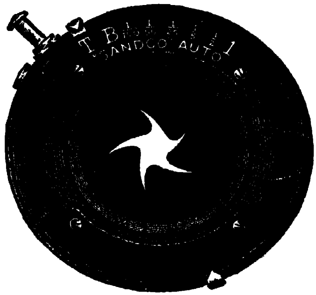
Messrs. Houghtons have also placed on the market a wooden printing frame at a low price in competition with the large trade done in this description of goods by Bavarian makers. These "Ensign" wood frames are very strongly made, the joints being formed by a strong section-cutting of the separate pieces, whilst the ends of the frame (which are provided with thumb spaces) are one with the frame proper. The hinged back gives a three-quarter view of the print, and is formed with a rabbet, thus affording very complete protection to the printing paper. The frames are made in a series of sizes, the prices being 5d. in quarter-plate, 8d. in postcard, and 10d. in half plate.

"SANDCO" DIAPHRAGM SHUTTERS.

(Sold by Staley and Co., 24, Thavies Inn, London, E.C.)

Four series of extremely neat between-lens shutters, of American manufacture, are now being supplied by Messrs. Staley. Each is

marketed under the designation "Sandco," the various models being distinguished by the suffixes "T.B.I.," "Variable," and "Auto." The "T.B.I." has one instantaneous speed in addition to "time" and "bulb," and is made in two sizes with light-apertures 9-16th and ¾-in., price 8s. 6d and 12s. 6d The "Variable" model is made in two patterns, one with 3 and the other with 4 instantaneous speeds. The former is made in the two sizes just mentioned, price 10s. and 15s. The latter is made in the further size of 1-in light-opening, the prices of this series being 12s 6d., 16s 9d, and 21s respectively. In the case of the "Auto," which has a full



range of speeds from 1 second to 1-100th, there are four sizes of light-openings, ¾-in., 1-in, 1⅜-in., and 1-½ in., the prices being £1 5s, £1 10s, £2 5s, and £2 10s. The whole series is extremely neat in appearance, being of black finish with the metal speed and lens-aperture plates neatly outlined in aluminium The shutter is set to the different speeds by sliding a pointer along a scale, whilst the release is by a sturdy little plunger on the top of each shutter; there is also screw connection for pneumatic or "Antinous" release. Judging from a visual inspection of the shutters we should say that the speeds are very fairly accurate, whilst the mechanical finish of the shutters is of an exceedingly good description.

THE "DOMINION" STUDIO LIGHT.

(Sold by O. Sichel and Co., 52, Bunhill Row, London, E.C.)

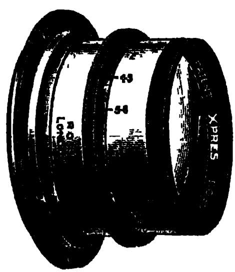
In this installation of the new half-watt metallic-filament lamps arranged for studio portraiture, the makers adopt the use of a curved reflector, within the curve of which are suspended six lamps each of which is shielded on the side towards the sitter so that the whole of the illumination is by reflected light. The lamps are further fitted with diffusing screens, the resulting lighting being of an extremely soft character and permitting of portraits being made fully equal as regards effect and shortness of exposure to those by daylight. The installation is economical in current and calls for no electrical adjustment the part of the user, the lamps being switched on and off like

those of the ordinary type. Moreover, the perfect steadiness and constancy of this form of illumination are points immensely in its favour for studio work. The price of the complete installation inclusive of wiring up to the switches ready for erection is £21. A smaller model containing four lamps is supplied at £15 15s., whilst a further portable installation of three lamps, mounted with a reflector which is arranged on a collapsible framework, is supplied at £15. When erected, it measures 8 x 7 x 2 ft. Closed, 7 ft. 6 ins. x 2 ft. 4 ins. x 8 ins.

THE ROSS "XPRES" LENS.

(Made by Ross, Ltd., Optical Works, Clapham Common, London, S.W.)

In this new lens the construction is quite distinct from that of Messrs. Ross' "Homocentric," an objective which held and still holds deservedly a reputation for high optical quality, in particular, absence of zonal aberration. In the "Xpres" the makers have been enabled to produce an instrument the aperature of which is $f/4.5$, throughout the whole series of focal lengths from 4¾ to 12 ins. The lens is corrected as a whole; the separate components are not for use by themselves, in which respect the lens is similar to the majority of $f/4.5$ objectives which have appeared during the last few years. At its full aperture the lens covers the plate for which it is listed from corner to corner with the most critically sharp definition. We examined the No. 3 of 6 ins. focal length and supplied for 5 x 4 plates. At a medium stop the lens excellently covers a considerably larger plate, and thus allows of ample use of the rising front in ordinary cir-



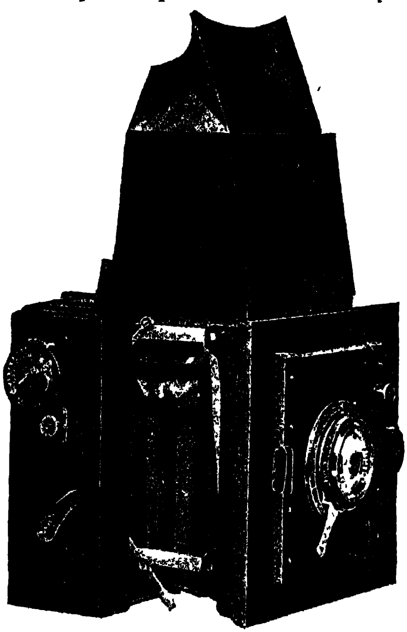
cumstances. But a distinguishing feature, and one which deserves to be emphasised, is the extreme brilliance of the optical image, by which we mean freedom from flare or veil and non-liability to give fogged negatives when used "against the light." In practical work, such as Press photography, home portraiture, and the taking of sport subjects, this quality is of almost as great importance as covering power; in fact, for many subjects, of really greater importance. Equally, for the purposes of users of small cameras, the extremely fine character of the definition is a notable advantage, the negatives yielding enlargements which are practically indistinguishable from results taken direct. In these

respects the "Xpres" lens has very positive advantages to offer the photographer, and its introduction will certainly add to the high reputation in optical manufacture which the makers have enjoyed for so many years past The price of the "Xpres" of 5¼ ins. focal length (for ¼-plate) is £5 12s 6d., of the 7¼-in (for ½-plate) £8, and of the 12-in. (for whole-plate) £22. The smaller lenses provide for all the purposes of hand-camera photography, whilst those of greater focal length are well suited for portraiture.

MARION'S FOLDING REFLEX CAMERA.

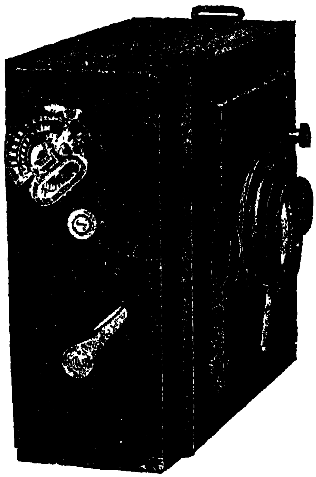
(Sold by Marion and Co., Ltd., Soho Square, London, W.)

Reflex cameras, like any other commercial articles, owe a great part of their sales to their deportment in the hands of the salesman, and a camera which, when handled over the shop counter, is seen to be smooth and simple in operation is more likely to be popular,



and, moreover, as regards convenience, is more assured of pleasing its buyer. In this preliminary respect we could not want a more satisfactory design than that of the Marion camera. Removing the instrument from its wrappings, we saw a pair of grips at either side of the lens. Grasping these and drawing them forward—the

obvious thing to do—the camera was partly opened on its struts, disclosing on the lower pair of struts two short levers. Pressing these down—their position suggested this as obviously the next operation—the front was firmly locked in its extended position, and at the same time the top of the bellows closed in by a leather-covered metal plate. The movement, although two-fold, is more quickly done than is the opening of an ordinary folding focal-plane camera. We next discovered to the rear of the camera a small stud which, on being displaced horizontally, released the hood, which erected itself, whilst at the same time the mirror came into position. The camera was ready for use, and this by three simple touches which were, upon the face of it, the only adjustments which could be made, and are made with the camera in the ordinary position.



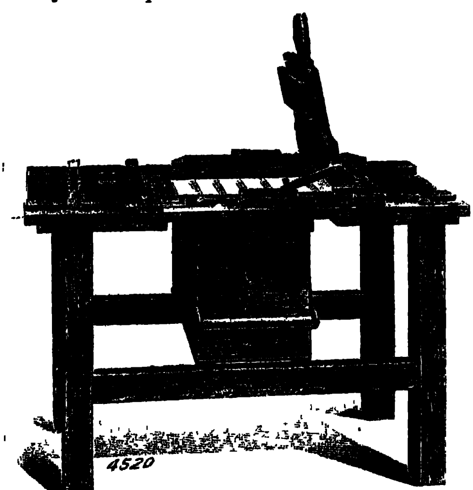
Like most other folding reflexes, the "Marion" is of single extension pattern, with the lens in a focussing mount, a limitation which is of lesser importance now that large-aperture objectives of the telephoto type are available. The front, however, has a fair rise and fall—half an inch in each case—and as the camera is built square, with a rotating back, the rise and fall are obtained both upright and horizontal way of the plate. The shutter is the Nettel focal-plane, an instrument which is one of the best, and exceptional in its range of the useful low speeds, in addition to those of the highest rapidity. In respect to the mounting of the mirror, the self-falling system is adopted, the shutter returning to the down position on releasing the exposure trigger. Our personal preference is for a spring-raised mirror, but the gravity pattern greatly simplifies construction, a matter of more than ordinary importance in a folding reflex. Altogether, the camera is one of

excellent pattern; mechanically it is of a very high order, and its bulk when closed marks a great degree of compactness, for it is only 8 x 6½ x 3 inches. In the quarter-plate size, the only one in which it is listed, its price is £17 10s., with three double book-form dark slides, but without lens.

THE "PAWL" BROMIDE STRIP PRINTING MACHINE.

(Made by Houghtons, Ltd., 88-89, High Holborn, London, W.C.)

This machine is designed for the special purpose of printing post-cards and cabinet prints from half-plate negatives on strips of bromide paper taking six pictures. It is constructed to operate extremely quickly since the working is entirely mechanical as regards shifting the paper strip forward for each successive exposure. Not only this, but the adjustment is thereby most accurate, for it does not depend in the least upon the exactness with which the human operator works. The frame holding the negative is provided with the necessary carriers and masks, a large bar, something like a towel rail, on the front of the machine being instantly depressed to fix the negative firmly in place The paper is as quickly attached to a wooden clip on the left-hand side of the machine. The movement of the pressure pad on to the paper at the time of exposure, and away from it after exposure, also moves forward the strip of paper by exactly the requisite amount. This is done by a very



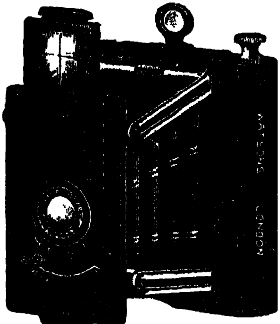
simple pawl mechanism from which the apparatus takes its name. The notched metal piece by which the paper is moved forward is exchangeable with another, one serving for postcards and the other for cabinet prints. For the latter a pair of parallel bars

likewise come away instantly from the bed of the machine so as to provide space for the wider band of paper. The use of the machine is of the most rapid kind, the six successive exposures being made by simply the operation of the handle of the pressure pad. The apparatus is supplied complete with the two iron notched pieces, four wooden masks, two lamp-holders and flexible connection, and bayonet holder for electric light, price £4 13s. 6d. The model for gas as the source of light costs £5 18s. 6d. In each case the machine can be readily affixed to any working bench, which requires to be cut so as to admit the lamp-box of the printer, but Messrs. Houghtons supply the solidly made bench shown in the photograph at the extra price of £1. The whole apparatus is most substantially made, chiefly in teak, with brass fittings; it is of a kind which may be adopted with confidence for rapid and accurate work under any climatic conditions.

THE "MITE" VEST-POCKET FOCAL-PLANE CAMERA.

(Sold by W Watson and Sons, Ltd., 313, High Holborn, London, W.C)

This camera, which takes plates or film-packs of the 45 x 60 mm size, is, so far as our recollection goes, the only one fitted with a focal-plane shutter As shown in the drawing the lens front is supported on four spring struts, focussing being done by the focussing mount of the lens, which can thus be adjusted for objects from infinity up to 4 ft distant The camera is fitted with a direct-vision finder provided with a proper sighting glass The front frame of



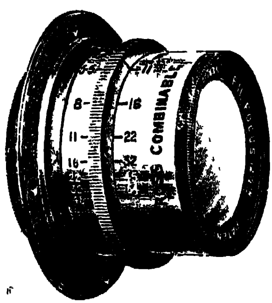
the finder slides down over the lens, forming an efficient cap for it. The focal-plane shutter is of the one-tension pattern, alteration in the speed being obtained by adjustment of the width of the slit, readily made by pulling out the winding key a short distance and adjusting the lower blind to a given point on a scale marked on the back of the camera and directly indicating the exposures. The camera is fitted with focussing screen, provided with hinged cover, and carries single metal dark-slides of light strong pattern. A film-

pack adapter can be supplied for it at an extra cost of 5s. Complete with six single dark-slides, the price is £5 10s. with Aldis anastigmat, or £3 10s. with "Aplanat" lens of aperture of $f/7.7$.

THE ROSS "COMBINABLE" LENS.

(Made by Ross, Ltd., Optical Works, Clapham Common, London, S.W.)

In this new lens the makers provide a type of instrument which should achieve much popularity with the more serious kind of amateur photographer as well as with outdoor commercial photographers. The instrument is an anastigmat of aperture from $f/5.5$ to $f/6.3$ whilst its separate components are also fully corrected anastigmats of greater focal length. The lens is issued in two forms. In one, the components are of the same focal length, which is a little less than double that of the complete lens. In the other, the components are of unequal focal length, e.g., in the case of No. 12 for half-plate the whole lens has a focus of 7½ inches, whilst the components are 11¼ and 14½ inches. Thus in this type the photographer obtains three lenses in one, or if one takes into account the

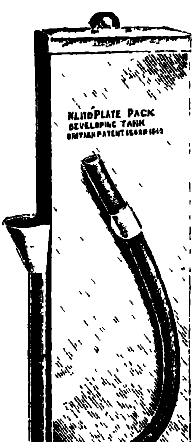


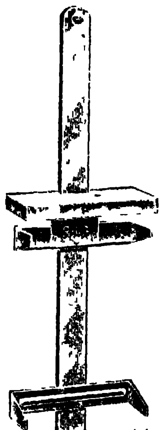
larger plate which the whole lens will cover when slightly stopped down, four lenses in one. In the symmetrical model, the full aperture is $f/5.5$; in the unsymmetrical type it ranges from $f/5.7$ to $f/6.3$. The components, in all cases, work at $f/11$. In the case of both the complete lens and the single component, the definition over the field for which the lens is listed is exceedingly fine. We examined the No. 7 of 6 inches focus and with each component 10¼ inches focal length. At full aperture the 5 x 4 plate is covered to the corners, whilst by stopping down to a medium aperture the half-plate is well covered, although the lens is not designed with a view to its use as a wide-angle. The prices of the "Combinable" range from £7 15s. to £26 15s., whilst the single components are sold by themselves in the case of focal lengths from 7 to 14½ inches at prices from £4 5s. to £7. The components are also issued as three separate sets, suitable for users of quarter plate, half-plate, and whole-plate cameras, respectively.

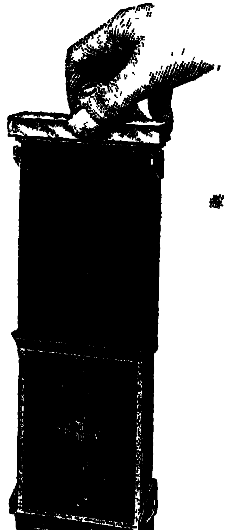
THE "KLITO" PLATE-PACK FOR DAYLIGHT LOADING AND DEVELOPMENT.

(Sold by Houghtons, Ltd , 88-89, High Holborn, London, W.C.)

In this system of providing the plate user with the facility of making negatives without the use of a dark-room at any stage the plates are carried in light-tight envelopes, each containing two plates Within this envelope they are held in a stiff metal frame, the lower part of which forms a sort of trough into which the end of the outer cover of the plates fits, making a light-tight joint. For the exposure of the plates in the camera a simple form of adapter, not unlike that used for a film-pack, is employed, the adapter





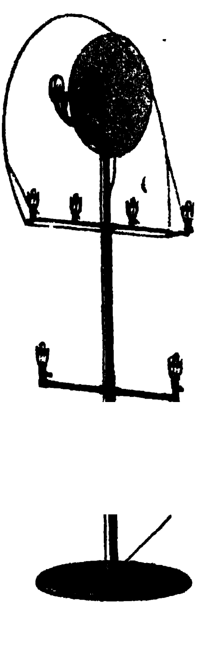


allowing of the covering envelope being withdrawn and replaced when making the exposure. By arrangement with the Imperial Dry Plate Company Messrs. Houghtons supply the Imperial "Special Rapid" plates ready in the light-proof envelopes, a dozen quarter-plates thus packed being supplied at 2s. 3d. Those purchasing the plates in this way have no need to make use of a dark-room, but it should be said that the envelopes and frames can be recharged after exposure with any plates, provided that the worker elects to develop the plates in the ordinary way instead of by the special daylight method devised by Messrs. Houghtons. This, by the way, for the benefit of the economically minded; we must return to the system as planned for use in daylight from first to last.

After exposure three of the envelopes (six plates) are placed in the rack of a special tank, the rack inserted in the tank, the lid put on, and the projecting handle of the rack then thrust down. This movement withdraws the plates from their protecting envelopes, and lowers them to the bottom half of the tank, the envelopes remaining above. Development is now done by pouring in the solution at the side of the tank, and the plates are developed just as in any ordinary pattern of tank. The "Klito" tank permits of the developer being run off, of the plates being rinsed in clean water, and, if necessary, of fixing being done in the tank. The system has evidently been thought out with much care, and will no doubt appeal to many who have longed for the same facility in the daylight use of plates that is obtainable with films. The price of the adapter is from 5s. to 7s 6d., according to the make of camera. Focussing screen for use with it is sold at 4s. 6d, whilst the developing tank is supplied, price 12s. 6d

THE "SURE" STUDIO LIGHT

(Made by the Tiess Co. 4, Rathbone Place, Londo W.)



In this lamp for the portrait studio a combination of magnesium flash and incandescent gas is used. The drawing clearly shows the design of the lamp. In the case of many subjects the two lower burners can be dispensed with. The flash powder is contained on a small plate and is very fully and certainly ignited by a quite large gas flame, the by-pass of which is operated by a cord The direct light of the flash is screened by a metal plate, the reflected light being further diffused by a paper screen attached to the lamp standard. The gas burners are of a special pattern, of full size, but fitted with small mantles, which thus yield an extremely intense light. This system has the further advantage that it obviates many of the troubles due to insufficient gas pressure The lamp does not call for an extra large size of supply pipe, one of half-inch diameter being sufficient, but the supply should be obtained through a meter of sufficient size, *e.g.*, of ten burners. Very little flash powder is consumed for the portrait, only about ten grains, whilst the lightness of the whole apparatus is one of its many strong points, since it allows of the light being readily moved about the studio. The price of the complete installation is £3 19s. 6d.

THE ALDIS F/4 5 ANASTIGMAT.

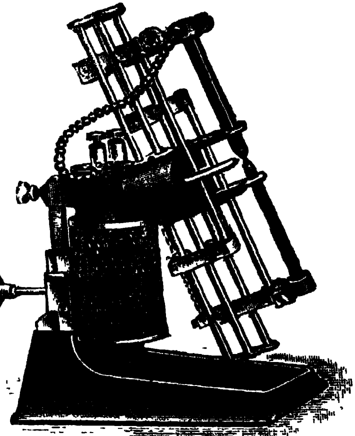
(Made by Aldis Bros., 13, Old Grange Road, Sparkhill, Birmingha

A further addition to the series of f/4.5 anastigmats which we described in last year's "Almanac" has been made by Messrs. Aldis in the shape of an instrument of 8½ inches focal length for half-plate. Like others of the series, it is for use as a complete instrument only, and, as we have found, yields exceedingly brilliant and critical definition over the half-plate, and allows also of the front being considerably raised above the centre. Users of reflex or folding focal plane cameras can hardly want a better lens for their work and certainly will not be able to find one which is more moderately priced, namely, at £6 15s. At this price, the lens will tempt many users of smaller reflex cameras for which a large-aperture lens is often an inestimable boon in figure study work where one wants the combination of both focal length and extreme aperture, the one for taking a more distant standpoint and so avoiding the notice of the subject and the other for the full effect of light which is necessary in the difficult conditions under which much of such work for the Press is very frequently done.

THE "SOLAR" AUTOMATIC PROJECTION ARC LAMP.

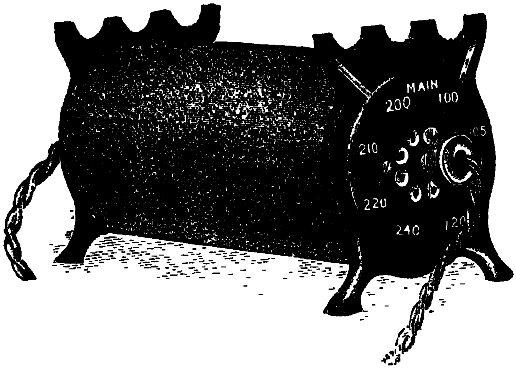
(Sold by the Westminster Photographic Exchange, Ltd., 111, Oxford Street, London, W., and 119, Victoria Street, London, S.W.)

This new automatic and British-made arc lamp is of an extremely effective pattern, and calls for not the slightest manipulation in



use. The lamp is supplied with a resistance by which it can be used on circuits ranging from 100 to 240 volts. Beyond inserting

the plug in the socket marked on the resistance with the voltage that is being used there is nothing more to do than to insert the second plug into any lamp-holder. A special feature of the lamp is the ball mounting of the carbons by which the arc is kept steadily to the front, resulting in great light-efficiency and steadi-



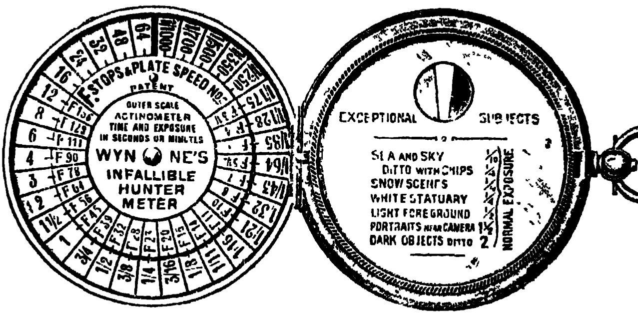
ness of the light. We have used one of the lamps with great satisfaction, and can recommend it for lantern work as well as for enlarging. The lamp is supplied on a tray of very rigid form measuring 4¾ by 6 inches, whilst the height of the lamp is 9 inches The price of the complete outfit is £5.

THE WYNNE "HUNTER" EXPOSURE METER.

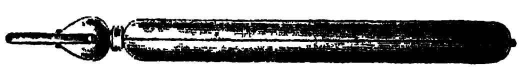
(Made by the Infallible Meter Co , Wrexham.)

Those who know and have used a Wynne meter will need no words of recommendation from ourselves as to its convenient design and reliable indications. For many years past the makers have retained a standard pattern without alteration, and, speaking for ourselves as a regular user of it, there seemed little scope for its improvement in any direction. Yet we hasten to admit that a new pattern, introduced under the name of "Hunter," is one which presents many advantages over the original instrument. As its name indicates, it is of the design of a hunter watch. By a touch on the spring-catch the two halves spring apart. One contains the sensitive paper and the two tints, together with a printed table of factors for subjects other than the normal one of a landscape or street scene with a fairly strong foreground. The other half contains the calculator, and consists of an outer rim bearing a series of numbers which, in accordance with the Wynne system, serve both as actinometer times and times of exposure, and of an inner disc on which is marked the series of *f* numbers, serving in like manner as measures both of the plate speed and the diaphragm apertures. As in the previous model of meter, the manipulation is of the simplest kind. The sensitive paper is moved forward to expose a

fresh portion behind the tint simply by turning the milled rim of the disc which carries the tints and factor table. The time having been noted, the plate speed number on the inner disc is set to this actinometer time on the outer scale, when the exposures for the whole series of diaphragms are immediately seen. In designing the new meter the makers have usefully extended the scale. The meter now indicates exposures up to—or, rather, down to—1,000th of a second, an extension from the 1/128th of a second which is the



shortest exposure indicated on the meter which we have. Moreover, the stop numbers now provide for an aperture of $f/3.5$, running from this figure up to the very smallest stops which are used with a lens. Also the manipulation of the calculator is easier than in the previous model, in which the outer scale was the one moved (by turning the glass cover to which it was attached). In the new model the inner disc is the one which is moved, a small stud being provided on it by which it is very readily moved to a nicety. And lastly, but by no means least, in these days of reduction of



weight and bulk, the meter is of an extraordinary degree of slimness; it is only about a quarter of an inch in thickness, yet is just as easily manipulated—in fact, more easily—than the previous pattern. The "hunter" form of construction, of course, dispenses with any glass in the instrument. Excellently made in solid nickel, the price of the new meter is 7s. As ordinarily supplied it is fitted with an f number scale on the central disc of the calculator, but interchangeable scales may be had with the U.S. or Goerz diaphragm marking, and a special scale is also supplied for Autochrome work. Price, each, 5d.

"N. AND G." BOOK FORM METAL DOUBLE DARK-SLIDES.

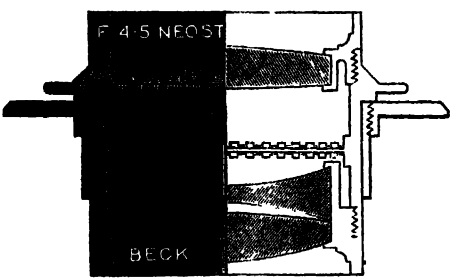
(Made by Newman and Guardia, Ltd., 17-18, Rathbone Place, London, W.)

Particularly to workers abroad an all-metal dark-slide possesses many advantages over one of wood. Messrs. Newman and Guardia, who, for years past, have supplied the customary single metal slides for fitting to their "Sibyl" and other cameras, have now issued double metal slides of their own design and manufacture. The slides are of book form, the two parts being very substantially hinged, and ample provision being made in the way of rabbets for the exclusion of light. The plate in each part requires simply to be laid in the slide, a simple turn-button holding in place the plate, which is covered by the metal spring partition. The slide is fitted with aluminium shutters, which draw out completely, but are latched against accidental withdrawal by a very simple form of spring catch. The slides represent the same nicety and high quality of construction such as Messrs. Newman and Guardia have embodied in their superlative "Sibyl" and other cameras. In the two sizes in which they are made, namely, 45 × 60 mm. and $3\frac{1}{2} \times 2\frac{1}{2}$ inches, the prices are 7s. 6d. and 10s. respectively

THE *F*/4.5 "NEOSTIGMAR" LENS.

(Made by R. and J. Beck, Ltd., 68, Cornhill, London, E.C.)

To the series of "Neostigmar" lenses, the excellent qualities of which we have referred to in previous "Almanacs," Messrs. Beck have added an instrument of *f*/4.5 aperture. It is of a simpler construction than the previous "Neostigmars," consisting of three single glasses. It is made in three focal lengths, namely,



5-inch for $3\frac{1}{2} \times 2\frac{1}{2}$ plates, 6-inch for quarter-plates and 7-inch for postcard size. As we found, by examining a lens of 6-inch focus, the instrument yields very fine and brilliant definition over the plate. The lens is one particularly suitable for reflex cameras and is issued at the extremely moderate prices of £3 15s., £4, and £5 for the focal lengths just mentioned.

THE NEWMAN-SINCLAIR CINEMATOGRAPH TRIPOD HEAD.

(Made by James H. Sinclair and Co., Ltd., 54, Haymarket, London, S.W.

In this universal head for the cinematograph camera the makers supply a real attachment de luxe for the use of the cinematograph operator. The head provides both rotating and tilting movements. The former is obtained by a steel disc, within the raised edge of which there rotates a deeply threaded pinion, which gears with a wheel screwed to the wooden head of the tripod. Thus the operation of turning the pinion by the handle which connects with it on the outside of the disc rotates the latter most smoothly, the disc itself turning on a three-ball support of the simplest description. A very simple spring device puts the pinion out of action so that

the camera can then be turned quickly round to point in any direction, whilst by putting back the spring the steady rotation of the handle can be instantly resumed. The unscrewing of a single screw gives access to the interior of the disc, and thus enables the cinematograph operator working in trying conditions, such as the dust and sand of many places abroad, to clean the mechanism in a few minutes. Moreover, the construction of the pinion and disc automatically takes up any wear in the gearing. Owing to the ball mounting of the disc and the smooth spring engagement of the pinion and disc the rotating movement of the head is of the smoothest imaginable kind and quite free from backlash

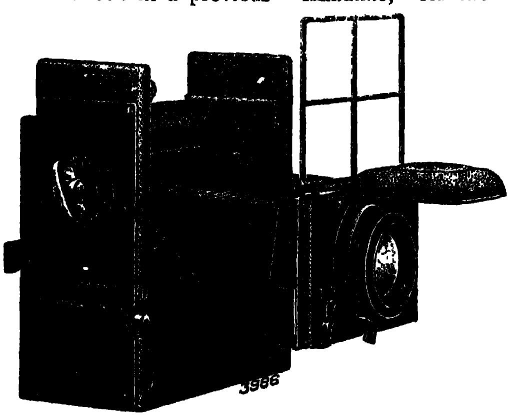
The tilting head is a separate attachment which can be fixed upon the rotating head by the ordinary camera screw, or the rotating head can be used equally well without it. The camera is

supported on an aluminium platform, which is tilted by a very smooth movement of a wheel and toothed sector. The movement can be made stiff or light, as required by the weight of the camera, by simple adjustment of a set screw. The rotating movement is made with an aluminium handle, which provides a very smooth and easy movement, but yet can hang free out of the way of the operator owing to its mounting on the end of the tube, which connects it with the operating pinion A word should be said in commendation of the method of securing the camera to the tilting head. This is done by cutting slots at each end of the head. Two screws are inserted into the bottom of the camera, and quickly fix the latter to the head through the slots, which are in most accessible positions. The whole mechanism is extremely light, yet of great strength, whilst the same description applies to the stout two-fold legs of the tripod, which, in the Newman-Sinclair construction have a special form of sliding leg which slides loosely (but is most rigidly held in place by quite a light turn on the set screw), and also preserves the full benefit of the triangular form of support for the tripod head The whole outfit represents the best informed knowledge of the requirements of the cinematograph operator, not only as regards obtaining certain movements, but also as regards securing them easily and rapidly and without a chance of mechanism going wrong at a critical moment. The price of the tripod complete with rotating and tilting head is £15 15s

THE "ENSIGN" FOCAL-PLANE CAMERA.

(Made by Houghtons, Ltd, 88-89, High Holborn, London, W.C.)

This camera, it is evident, is an offshoot from the Houghton folding reflex noticed in a previous "Almanac," for the movement



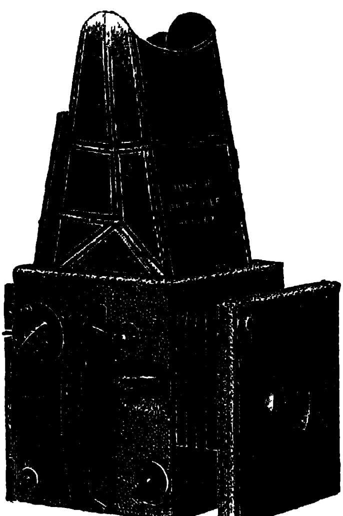
by which the lens is extended in front of the plate is the same as in the latter. It is a rapid and one-hand movement, more expedi-

tious in action than the customary device of spring struts. Moreover, it allows of the direct-vision finder being placed as closely as possible in correspondence with the lens itself, thus making for greater accuracy in securing the picture of a near object. In other respects the camera has the adjustment of shutter-speed and focussing customary in cameras of the folding focal-plane type, but in the case of the new "Ensign" the latest pattern of focal-plane shutter is used allowing of speeds from one-tenth of a second upwards to extreme rapidity, in addition to "bulb" and "time." The lower speeds are secured by a special breaking device which comes into operation also when exposing by "bulb" or "time" and thus contributes to the extreme smoothness and freedom from jar of the blind The camera has rise and fall of lens the upright way of the plate Complete, with three double dark-slides of solid pattern, with pull out shutters, and "Ensign" f/5 5 anastigmat of 5¼ inches focus in focussing jacket, the price, in the quarter-plate size, is £10 15s

"JUNIOR BRITISHER REFLEX" CAMERA.

(Sold by Staley and Co, 24, Thavies Inn, London, E C.)

In this new British made reflex camera, sold at the prevailing price of £9 15s, in quarter-plate size, with f/4 5 Aldis lens, exten



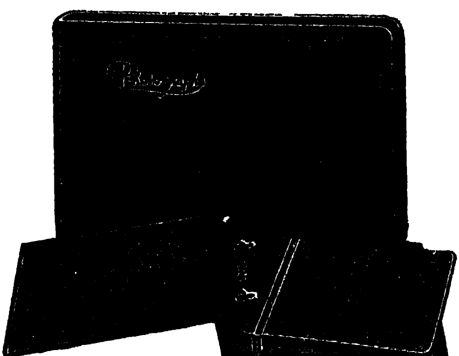
sion of 9½ ins is provided. The lens front has a rise of ¾-in., and is fitted with hinged shade which effectually protects the lens when down, the objective being mounted in a metal adapter, which is

readily fitted in a place after the manner of a bayonet joint. The hood can be instantly raised from the ground glass for cleaning the latter, whilst the back is of the permanently attached rotating pattern. The winding key of the self-capping shutter serves also to set the shutter to the various speeds, these latter being marked from 1-800th to 1-10th second. Further, the spindle of the shutter at the end opposite to that of the winding key is fitted for insertion of a small fan serving as an air brake by which the shutter can be caused to give exposures of ¼-sec. and ½-sec. The apparatus is specially distinguished by its light and strong build. Its price includes loose focussing screen at the back of the camera and dark-slides for six plates.

"SIMPLICO" LOOSE-LEAF ALBUMS

(Sold by Bartons', Cosway Works, Finch Road, Handsworth, Birmingham.)

In this album a pair of stout uprights of nickelled metal are provided upon which the leaves (perforated) are placed and securely fixed in position by turning over each a flat hook, which, by its shape, makes a quite firm lock. Externally the album has no appearance of being of the loose-leaf pattern, whilst even the pair of hooks, which are seen on opening the album, are in no way unsightly. At the same time, the operation of removing all, or any one, of the

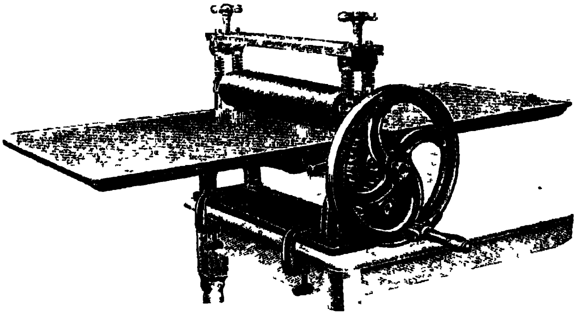


leaves is a matter of less than ten seconds. The leaf mounts themselves are of the really artistic and durable character of which Messrs. Bartons' have made a specialty. Of linen and other textures they please also by their extremely harmonious colours, chiefly grey, buff, and light brown. The cover of the album is of art fabric, bearing the title "Photographs." The album is made in four sizes:—6½ x 5, price 2s. 6d.; 8½ x 5¾, price 3s. 6d.; 9½ x 7, price 4s. 6d.; and 12 x 9¾, price 5s. 6d. In the case of each size, the album may be obtained to open either the long or short side of the leaf. Refills of twelve leaves are supplied at prices which are, respectively, 4s., 5s., 7s., and 9s.

THE SINCLAIR BROMOIL TRANSFER PRESS.

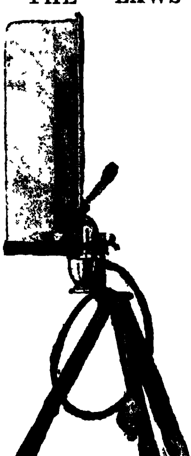
(Sold by James H. Sinclair and Co., Ltd., 54, Haymarket, London, S.W.)

For the working of the Bromoil transfer process Messrs. Sinclair supply a very well designed roller press of size ample for prints up to 17 inches in width. The press consists of a pair of hard wood rollers, having a solid iron core of one inch diameter, which forms the bearing for each roller. Special supports are provided for the



boards seen in the drawing. The necessary pressure can be adjusted by the top screws, whilst the handle of the press folds flat when not in use. The price of the press is £2 5s. Accessories in the shape of flat zinc sheet 28 x 17 x 1-16th inch, printer's blanket, 28 x 17, and a pair of millboards, 32 x 18½ inch, are supplied at 18s., or the whole outfit price £3 3s.

THE "LAWS" HOME PORTRAIT FLASH LAMP



(Sold by John J. Griffin and Sons, Ltd., Kingsway, London, W.C.)

In this flash lamp a principle is adopted similar to that in the "Laws" studio lamp, but the gas flame employed is acetylene, produced by a small generator, such as that used on motor cycles, which is attached to the flash chamber. The latter consists of a metal reflector measuring 16 ins. in height by 7 ins. in breadth. The acetylene burner is fitted through the back of this reflector, and projects downwards at an angle to the base of the latter. On this base the flash powder is placed, and is ignited by pressure upon a pneumatic bulb, which enlarges the acetylene flame. As with the studio lamp, the light is intended to be used entirely by reflection. The lamp is placed with its back to the sitter, and the illumination obtained by a suitably placed reflector. The apparatus is a very portable one, and is sold at the price of £1 15s. for the complete outfit.

THE "MERRETT" POSTCARD TRIMMER.

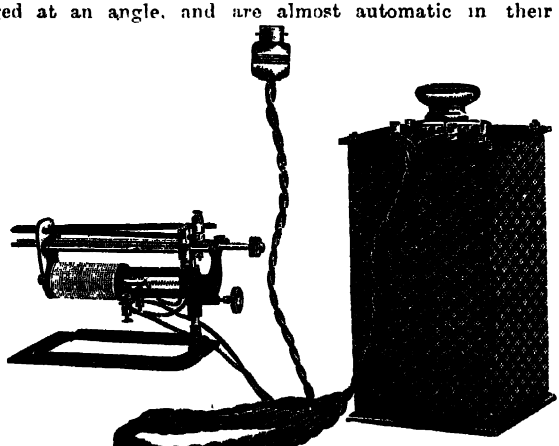
Made by the Adhesive Dry Mounting Co., Ltd., 27-28, Fetter Lane, London, E.C.

This addition to the series of "Merrett" trimming desks serves the special purpose of facilitating the rapid trimming of photo-postcards It is provided with a stop placed about one-sixteenth of an inch beyond the cutting blade, and thus provides a ready means of trimming off just such a narrow margin from bromide or gaslight postcards as serves to remove any raggedness due to damage to the emulsion film during developing or toning operations In the ordinary way such trimming up of postcards calls for an expenditure of time which usually cannot be given to prints such as these, which are supplied at low prices. With the new trimmer it is a matter of a few seconds to insert the four edges of the postcard successively under the guide and against the stop, and at each operation to trim off a narrow strip by pressure of the hands upon the board. The trimmer is of the same substantial construction as others of the same pattern, and is sold at 7s 6d

THE COLISEUM ENLARGING AND PROJECTION ARC LAMP.

(Sold by George T Collins, 57, Hatton Garden, London, E C)

A most convenient little arc lamp, for the enlarging or optical lantern, is a new introduction of Mr Collins. The carbons are arranged at an angle, and are almost automatic in their feed,



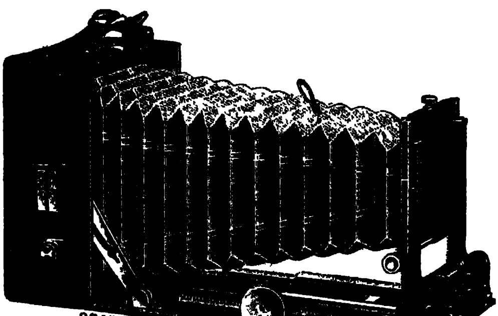
requiring only a turn or so of the pinion five or six times during their full burning period, which is two hours. Moreover, the magnetic mechanism by which the carbons are kept fed into position

also causes the arc to form from the extreme tips of the carbons, so that practically the whole of the light is within a very small area, and that directly to the front. Hence the lamp supplies a very intense and concentrated light for its consumption of current—namely, 4½ amperes. It is sent out complete with resistance, by which it is adjusted to any voltage of current, and, further, may be used on both continuous and alternating current—on the latter practically as silently and steadily as on the former. The lamp is very moderately priced at £3 3s.

TROPEX FOLDING HAND-CAMERAS.

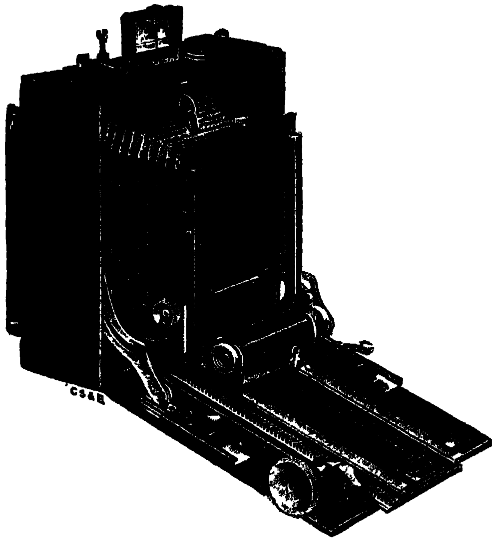
(Sold by the City Sale and Exchange, London.)

In this series of cameras the material throughout is a light metal, giving great strength and rigidity. On this account alone the instruments are particularly suitable for use in the tropics. And fortunately we are able to signalise them as embodying quite a number of useful and practical movements which distinguish them from the general run of cameras of this type. In the first place, the milled pinion head for focussing is of large diameter, making this operation one of the smoothest kind. A further handy feature is the arrangement of the single metal plate-holder and the focussing screen. Both of these find space for themselves in the groove at

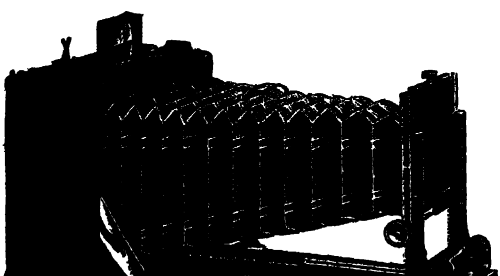


the back of the camera, the focussing screen being pushed forward into register by a spring, on the plate-holder being withdrawn. This system of dispensing with a loose focussing screen is one adopted years ago on American field cameras, and a very convenient plan it is in practice. One or two other movements are provided on the "de luxe" model of the series—namely, that fitted with a reversing back. The clips for the latter are raised simultaneously by an eccentric rod, and the operator thus spared the awkward job (with the camera held in the hand) of raising both springs at the same time. Also, in this model, the side struts of the camera back are mounted in sliding blocks, so that the movement of a swing back is provided, or, alternatively, the baseboard of the camera can be dropped to a considerable angle when using a wide angle lens

and cut-off thus avoided. In addition to great rise of front by rack and pinion, which is common to all models, the reversing back pattern has a special form of swing front, a very useful movement



at times. This model, also, is of triple extension, giving, at the full range, a distance of 14½ ins. from lens panel to plate, combined with exceptional rigidity. This in the quarter-plate size . in 5½ x 2½



the extension is 9½ ins. The camera is fitted with a direct-vision finder, provided with quick reversing movement when taking vertical pictures. The whole construction of the apparatus is of a very high

order. Price, without lens and with three slides, £6 in $3\frac{1}{2} \times 2\frac{1}{2}$, £6 10s. in quarter-plate, £8 in postcard, and £11 in half-plate.

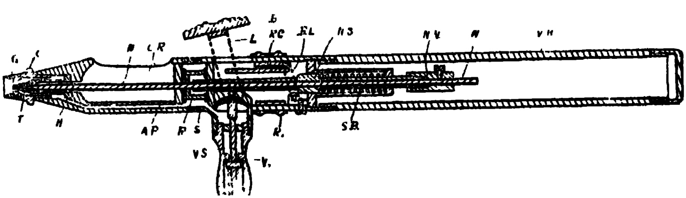
A similar high standard of quality is observed in the case of the other models, the movements of which are approximately those of the de luxe. Thus, the quarter-plate horizontal pattern has an extension of $10\frac{1}{2}$ ins., $2\frac{1}{4}$-in. rise, as well as cross front movement, in both cases by rack and pinion, reversing direct-vision finder and a spirit level. The price, with three slides, but without lens, is £6 5s., or £7 in postcard size. Another model is supplied to take vertical pictures, giving a 12-in. extension on the quarter-plate, $2\frac{1}{4}$-in. rise, and fitted with finder and level. Prices in quarter-plate and postcard, £5 15s. and £7 10s. respectively.

The cameras are also made in two pocket models, 45 x 60 mm and $3\frac{1}{2} \times 2\frac{1}{2}$ ins Prices as before, £4 5s. and £4 10s. And two further models are available for stereoscopic work on 4 x 6 or 7 x 5 plates. The whole series is one which is excellent mechanically, and provides the movements which are of every-day practical use.

"AEROGRAPH" IMPROVED MODEL A.

(Made by the Aerograph Co, Ltd, 43, Holborn Viaduct, London, E C)

In this improved model of their well-known air-brush, the Aerograph Company have embodied several methods of construction which in the past they have employed as alternatives in spray construction, with the result that the latest instrument represents what must surely be a stage of finality in efficiency and accessibility. As shown in the sectional drawing of the spray the needle N runs centrally through the instrument. The needle is removed in a few seconds by unscrewing the piece marked NN, whilst the mounting of the needle in this way yields most direct control of the colour. A packing box P forms an efficient check against colour getting into the working parts In the new model special attention has been given to the air valve V, the piece VS having



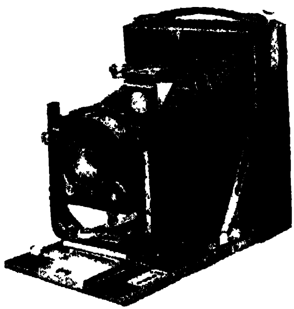
bearings at both ends which give a very accurate seating to the valve This part of the spray is made detachable so that when required the valve portion can be left attached to the rubber tube whilst the spray itself is put away. A special feature of the Aerograph, and one in which its qualities are particularly pronounced, is the regulating band R by which the instrument can be set to give a fine line of colour. For much retouching work, especially that in commercial subjects required for catalogue illustration, etc, really fine work is required of an air-brush, and in

this respect the "Aerograph" deserves to be specially distinguished among some of its competitors. It should be added that the whole front of the instrument may be entirely detached by unscrewing at S for cleaning, whilst all the parts are interchangeable, and are easily renewed. The price of the new model is £4.

THE "KOMPACTO" FOLDING HAND CAMERA.

(Sold by James A Sinclair and Co., Ltd., 54, Haymarket, London, S.W.)

In this camera Messrs. Sinclair are supplying a light but very strong and rigid folding camera of British make, fitted with the "N S" patent shutter, giving speeds from $1\frac{1}{2}$ secs to 100 secs., in addition to time. The camera is issued only in the quarter-plate



size, in which it has an extension of 10 inches, a fair amount of rise and fall, folding reversible brilliant finder, with level and rack-and-pinion focussing. It is provided with detachable focussing-screen, fitted with an efficient hood With Taylor, Taylor and Hobson $f/6.8$ anastigmat, and with one "Una" double plate-holder, the price is £6 6s.

DE LUXE "ENSIGNETTE" FOLDING CAMERAS.

(Made by Houghtons, Ltd , 88-89, High Holborn, London, W.C.)

Supplementing the ordinary models of the highly compact "Ensignette" camera Messrs. Houghtons have brought out a de luxe

model of the No. 2 "Ensignette," taking pictures 3 x 2 inches. In the case of this model, focussing is obtained very readily by a knob

DOROTHY PERKINS ROSE

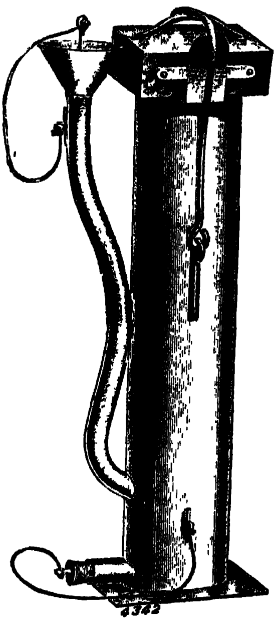
REPRODUCED IN NATURAL COLOURS BY THE M. S. S. PRESS LTD. FROM AN AUTOCHROME BY E. SANGER SHEPHERD. 12 INCH HOLOSTIGMAT LENS F 16. 10 SEC. EX. JULY 30 5 P. M.

SEE PAGE 610

moving over a graduated scale on the camera front, whilst the shutter is one of the between-lens pattern giving three instantaneous exposures marked at 1-25th, 1-50th, and 1-100th of a second in addition to time. The brilliant view-finder automatically comes into position for exposures landscape way of the film, and is quickly adjusted for vertical pictures. Fitted with Cooke $f/6$ anastigmat the price of this model is £6. It is also supplied fitted with "Compound" shutter, price £8 5s., with $f/6{\cdot}3$ "Tessar."

THE "ENSIGNETTE" DEVELOPING TANK, MODEL B.

(Made by Houghtons, Ltd., 88-89, High Holborn, London, W.C.)



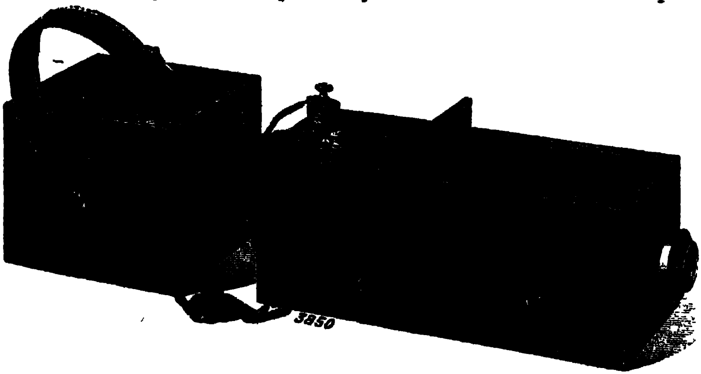
A very simple type of vertical daylight developing tank for the treatment of "Ensignette" six-exposure spools of film is shown in the figure. The spool of film is unwound for an inch or two and the end of paper wrapping inserted in a gripper, which is placed, with the spool of film, in the enlarged mouth of the tank. The lid is put on and the black paper wrapping then drawn off through a slit in the lid, by which operation the band of film is placed in position for development within the tank. Developer is then poured in, the funnel re-stoppered, when the tank can be rocked or inverted as much as required during development. The solution can be run off at the bottom, the film washed, and, if necessary, fixed in the tank, or it can be removed for fixing in a separate dish. The apparatus is most excellently made in nickelled metal. Price for No. 1 "Ensignette" film, 7s. 6d.; for No. 2, 12s. 6d.

ENSIGNETTE PICTURE PROJECTOR.

(Made by Houghtons, Ltd., 88-89, High Holborn, London, W.C.)

A neat little apparatus for the exhibition on the screen of the results obtained with the "Ensignette" camera has been introduced by Messrs. Houghtons. The light is a small metallic-filament lamp, slightly overrun and worked from an accumulator of 8 volts. The slides are made $2\frac{1}{2}$ x $2\frac{1}{2}$ inches, and are inserted in a slot in the top of the apparatus, whence they are pushed out again by a spring actuated by the lever seen in the drawing. With the lens, as fitted to the apparatus, a picture of about 30 inches is quite brightly

illuminated, and the excellent feature of the projector is its readiness for use anywhere independently of electric current. The price,

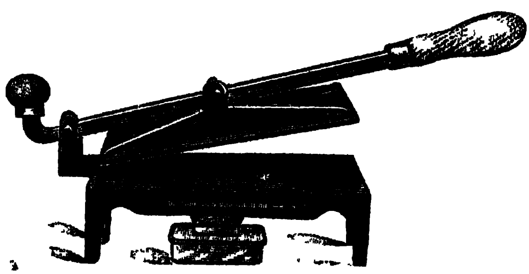


with two lamps, is £1 11s. 6d. Extra for accumulator of 5 ampères, £1 10s.; of 10 ampères, £1 18s.

THE COLISEUM DRY-MOUNTING PRESS.

(Sold by George T. Collis, 57, Hatton Garden, London, E.C.)

This inexpensive pattern of dry-mounting press has been improved in one or two respects since we noticed it in a previous "Almanac." It is now fitted with a knob, seen to the left of the drawing, on which one hand is placed, whilst the other is used to apply the pressure. This prevents the stand from tilting sideways on applying pressure. The base is also fitted with a channel for a thermometer.

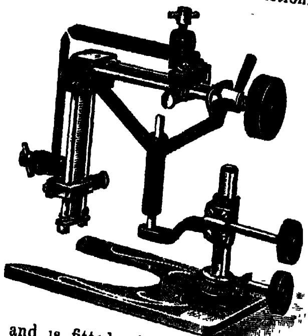


The press has a surface of 8 x 6 ins., but, as one side is open, mounts of very much larger dimensions than these can be inserted, and the press thus used, for example, for mounting several small prints on a large mount. Complete with spirit lamp and thermometer the price is 12s. 6d. A small ring gas burner can, of course, be used in place of the spirit.

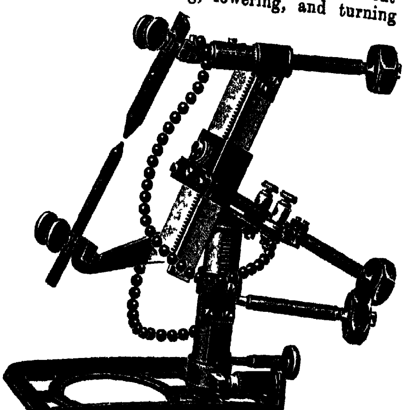
"CERVUS" PROJECTION ARC LAMPS.

(Sold by F. C. Hart and Co., 72, Wigmore Street, London, W.)

Messrs. Hart send us two new patterns of arc lamp, both made in London, and of very substantial construction. One is of right-



angle pattern, and is fitted with exceedingly well-cut screws for adjusting the carbons, raising, lowering, and turning the lamp.



There is separate adjustment for fixing the arc roughly in position, following which the rack and pinion movement is used. Another

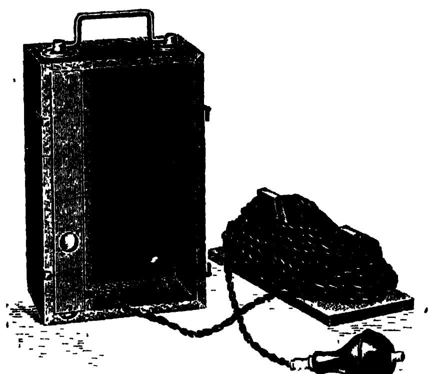
very useful adjustment throws the cogs driving the upright pinion (and its carbon holder) out of gear, so that the horizontal carbon may be separately adjusted. The lamp is made to take current up to 10 amperes. On a tray with mechanical adjustment, as mentioned and shown above, the price is 50s., or on a plain pin tray 33s. Resistance, ranging from 100 to 220 volts, 12s. 6d.

The second lamp is one for larger work, taking current up to 30 amperes. It is fitted with exceedingly smooth movement for the carbons as well as with a simple adjustment for centering the light. A special feature is the open construction by which it is almost impossible for parts of the lamp to jam by over-heating. It is certainly a very suitable lamp for the most exacting conditions of cinematograph and lantern projection. The price is £5 5s.

THE LANTERNISTS' ELECTRIC SIGNAL

(Sold by F. C. Hart and Co., 72, Wigmore Street, London, W.)

This very convenient silent signal for the lantern operator consists of a case of polished wood containing a dry battery and a small electric glow lamp The case also contains a bell-push and 56 ft. of flexible cable, which is wound on a loose holder, for which space



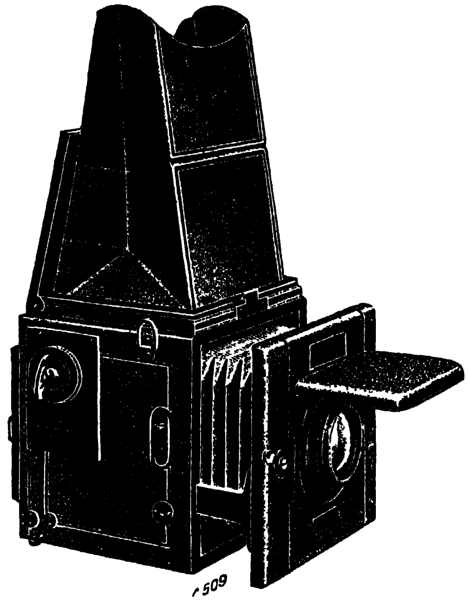
is provided in the box. When the cable is in use the empty space in the box serves for holding lantern-slides to the number of a few dozen. The whole outfit is very nicely made, and should surely be appreciated by lantern lecturers who desire the acme of smoothness in the exhibition of the slides The price is £1 1s. 6d.

THE "ENSIGN-POPULAR" REFLEX CAMERA.

(Made by Houghtons, Ltd., 88-89, High Holborn, London, W.C.)

In adding this model to their series of reflex cameras Messrs. Houghtons have provided a remarkably strong, light, and efficient quarter-plate reflex at a very popular price. Without a lens and with six single metal dark-slides, the camera sells for £5 10s., or at £9 10s.

with Aldis $f/4.5$ anastigmat or Cooke $f/4.5$ "Luxor" anastigmat. Yet this low price does not preclude the provision of the most important movements of a reflex camera. The focal-plane shutter is wound and set by the same half or three-quarter turn of the winding key, and gives a wide range of exposures. Though of single extension, the camera allows of the use of fixed-focus telephoto lenses, such as the "Adon" or "Telecentric." The lens front is fitted with



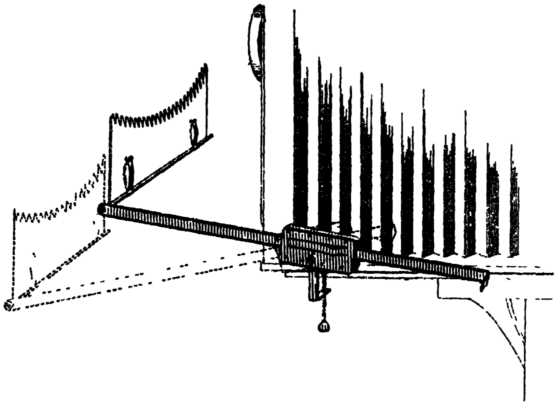
rack-and-pinion rise and fall, and with a deep hood, which effectively protects the lens, and can be set in any position as a sky-shade. A detachable reversing back is fitted. It carries the single metal dark-slide, and also a hooded focussing screen for use when the camera is used (without the mirror) as an instrument of the ordinary type. The camera is covered in black fine-grained leather, and the metal fittings are either of enamel black finish or nickelled.

THE "APTUS" CAMERA VIGNETTER.

(Made by Moore and Co., 101-103, Dale Street, Liverpool.)

This is a simple form of vignetter for attachment by the clamp provided to the camera baseboard. It has ample movement to and fro, the stout nickelled bar sliding very smoothly in its bearing. Moreover, the vignetter can be raised or lowered from the rear of

the camera and likewise angled upon its support by turning the clips which hold it upon a rod across the front of the camera. The whole

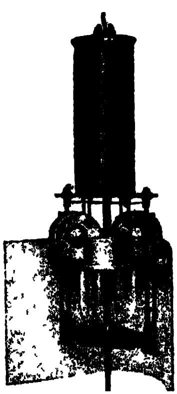


fitment is very strongly made, and, complete with ground celluloid vignetting mask, is sold at 10s 6d.

WESTMINSTER STUDIO SMALL ARC LAMPS.

(Made by the Westminster Engineering Co., Victoria Road, Willesden Junction, London, N.W.

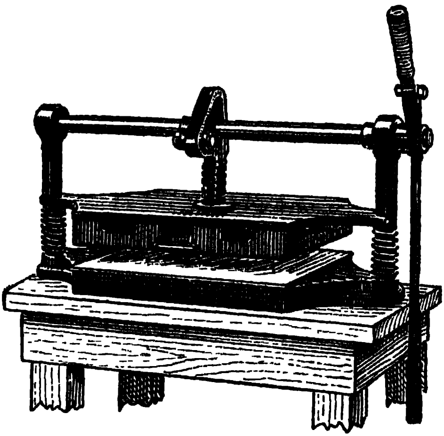
To meet the requirements of those who prefer to adopt a system of studio lighting by means of a series of five or six small arc lamps the Westminster Engineering Company have recently adapted one of their models for this purpose The lamp, No. 131, is made to burn about three amperes in single parallel on 100 or 200 volt circuit, or two in series on 200 or 250 volts. It yields a very bright arc of about $1\frac{1}{4}$ ins. in length, burning within a pear-shaped globe, which is readily attached and detached for renewal of the carbons. An average time of burning, without the necessity of renewal of the carbons, is six hours, which leaves a very wide margin even in the case of the busiest studio. The lamp is fitted with a reflector, as shown in the photograph, and the height from the lower edge of the latter to the point of suspension of the lamp is just under 2 ft. For single burning the lamps are supplied at £3 15s. each, or for series burning at £4 5s., in each case without reflector, which costs a further 9s. 6d. in the case of the ordinary pattern of lamp or 7s. 6d. in the case of the top pattern.

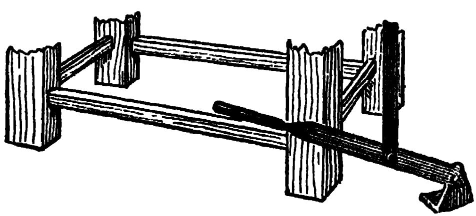


A FOOT PRESSURE DRY-MOUNTING PRESS.

(Made by the Adherent Tissue Co., Ltd., 117A, Fore Street, Upper Edmonton, London.)

In this pattern of dry-mounting press a greater speed of working is secured by foot in place of screw pressure of the plate. Pressure is obtained by the footlever instead of by the more slowly acting screw, a system which has the further advantage of leaving both hands of the operator free for manipulation of prints and mounts.





The size of the heated box is 16 by $12\frac{1}{2}$ ins., the width between the arms being $24\frac{1}{2}$ ins. A 15 by 12 print can thus be mounted on a $24\frac{1}{2}$ by $17\frac{1}{2}$ board at one pressure, or a 25 by 16 print on 36 by $24\frac{1}{2}$-in. board at two pressures. The price is £5 5s.

THE "PRESSMAN" POSTCARD REFLEX.

(Sold by W. Butcher and Sons, Ltd., Camera House, Farringdon Avenue, London, E.C.)

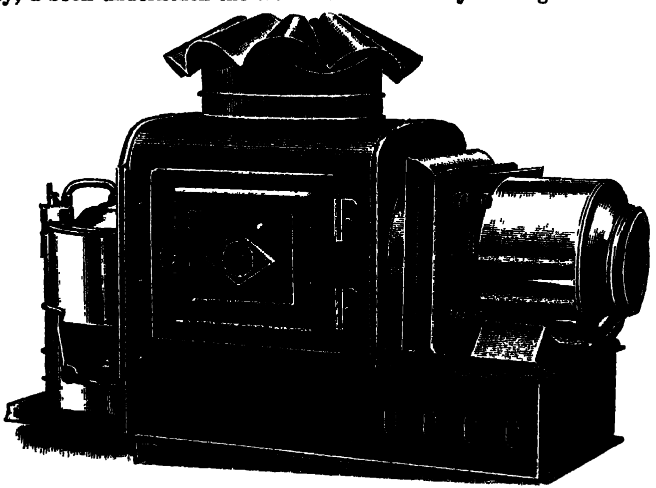
The "Pressman" reflex camera is now issued in the postcard size. The instrument is of oblong pattern and of size within 7 x $6\frac{1}{2}$ x 7 ins. The extension is 10 ins. The camera is quite on the lines of the

previous quarter-plate "Pressman," having the convenient four-slit blind of the focal-plane shutter, with its adjustment for a series of successive exposures with different slits, or, alternatively, for repeated exposures with the same slit. There is rise of front of about half an inch with the same amount of fall, whilst the movement of the self-falling mirror is very smoothly balanced. The camera is fitted with the Aldis $f/4{\cdot}5$ anastigmat of 6¾-in. focus, whilst the shutter is readily adjustable to give a range of speeds indicated as from 1-15 to 1-1,000 of a second. With hooded focussing screen at the back of the camera for use with the mirror locked in the up position and when the camera requires to be used at the eye-level, the price is £12 15s., which includes six single metal slides. Camera and six slides, without lens, £8 5s.

THE LUNA "PAMPHENGOS No. 2" LANTERN.

(Made by W. C. Hughes and Co., 82, Mortimer Road, Kingsland Road, London, N.)

This optical lantern, made in Messrs. Hughes' own workshops, is fitted with the "Luna" spirit mantle lamp, the very high power of which and the convenience of which in use we have alluded to in past "Almanacs." The lantern body is built with a supporting bar at front and rear, with the result that it can be tilted by putting, say, a book underneath the front without thereby making the lantern



unsteady nor causing the light to get out of centre owing to the fouling of the lamp tray against the table on which the lantern is placed. The foot at the rear end of the lantern causes the lamp tray to stand clear. The lantern is of Russian iron with solid brass front, the whole front being mounted in guides and coming away in a moment, so that the condenser is likewise instantly removed. This

movement allows of a sufficient space for small experimental apparatus which it may be desired to project on the screen. The front is fitted with single brass draw tube, the carrier stage is open at the top, and the lens is fitted with double rack and pinion and flashing shutter. The projection lens is of 2-inch. diameter and 6-inch focus, whilst the condenser (4 inches diameter) is likewise of short focus. The lamp reservoir is now made somewhat larger so as to yield a continuous light for two hours. The whole instrument is one which can be recommended for pictures up to, say, 12 feet diameter—which size requires a distance from the screen of 22 feet—yielding a very bright projection and independent of any gas or electric connection. The price, complete in light iron case, is £5.

THORNTON-PICKARD "SPECIAL RUBY" REFLEX CAMERAS.

(Made by the Thornton-Pickard Manufacturing Co., Ltd., Altrincham, Cheshire.)

In the latest model of this reflex camera a number of minor improvements are made which still further contribute to the efficiency

of the instrument and certainly make it one of record value in relation to the price charged for it. In the past Messrs. Thornton-Pickard have shown their ability to supply extraordinary value in

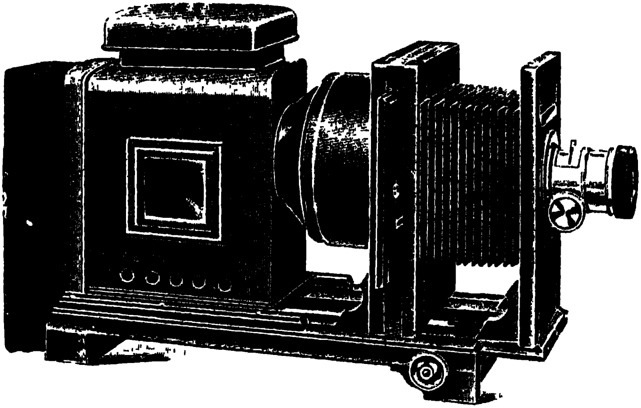
cameras of the reflex type, as well as in those of other patterns, and it deserves to be mentioned that in the case of the "Special Ruby" prices are now appreciably less than those of a year ago. Thus, in the case of the quarter-plate camera, fitted with a Cooke *f*/4.5 anastigmat, the price is only £8 15s. as compared with £12 5s. When it is borne in mind that the lens alone, if purchased separately, would cost the buyer £5 15s., it is evident that the set supplied by the Thornton-Pickard Company is indeed most remarkable value. If fitted with a Beck *f*/4.5 "Bynar" the price is £8 10s. As regards the camera itself it is perhaps hardly necessary to recapitulate its features. A very strong point is the self-capping focal-plane shutter of the simplest imaginable type in use. The single operation of the winding key sets the shutter and brings it to any one of the required speeds. An adjustable stop provides the convenience of the shutter being wound each time to any desired speed (for which the stop is set) without attention. Another very good feature is the self-erecting hood which shows the picture in every part of the focussing screen. A further useful point is that when closing the hood the mirror is automatically moved into the up position and held there, the camera thus becoming one of the ordinary pattern The movement is particularly useful when using the reflex on a stand as it entirely absolves the operator from troubling about the adjustment of the mirror. The camera has a long extension (sufficient for the half of a 6-inch anastigmat), and the lens is carried in a reversible box which, in the ordinary way, affords excellent shading of the lens. In all the sizes in which the camera is made, from quarter-plate to 7 x 5 inches, it is built square and fitted with rotating back. There is a good amount of rise of front, over 1 inch in the quarter-plate size, and half an inch fall. The finish of the camera, black Morocco leather and ebonised wood, with the metal parts of black oxidised enamel, is handsome in appearance and efficient in use.

"NATIONAL" AND "RECORD" ENLARGING LANTERNS.

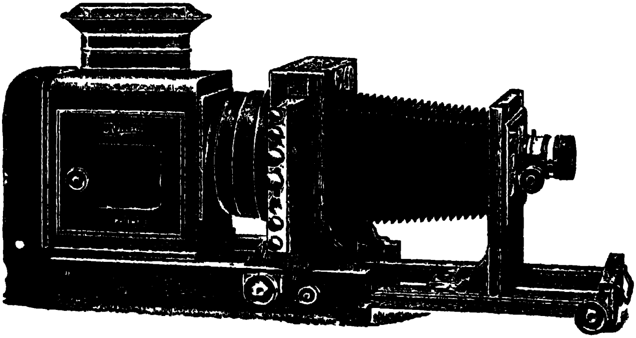
(Sold by W. Butcher and Sons, Ltd., Camera House, Farringdon Avenue, London, E.C.)

In the "National" enlarger Messrs. Butcher provide a really most efficient instrument for quarter-plate negatives, or smaller, at the price of £2 17s. 6d., inclusive of projection lens of Petzval type and *f*/4 aperture, fitted with orange cap The condenser is of 5½ inches diameter, and is fitted in a double Russian iron extending cone which makes a light-tight joint between condenser and the lantern body. The latter slides to and fro for adjustment of the source of light. The negative carrier is made square and of size to project a little on each side of the stage, thus allowing of a given portion of a negative being placed centrally for enlargement. Rough focussing is by drawing out the front on its runners, a set screw firmly clamping it at any point, whilst fine adjustment is provided by the rack and pinion movement of the objective in its tube. The whole apparatus is very well and strongly made in polished oak, and is really a thoroughly efficient enlarger of a simple type.

In the new model of their "Record" enlarger Messrs. Butcher have added a further refinement in the shape of a masking device for the negative stage. This consists of four separate and separately operated opaque blinds, the position of each of which can be adjusted to a nicety by milled heads outside the lantern so as to provide a

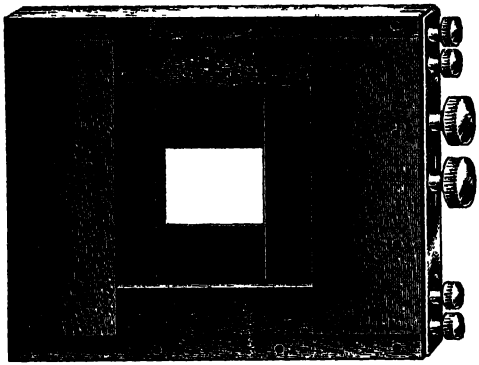


rectangular mask of any size or shape within the limits of the apparatus on any part of the negative. Such masking as this has the advantage of giving an enlarged print with white margin and, therefore, more easily trimmed. One sees also exactly what part of the subject is included in the enlargement, and the fixing of the paper to



the enlarging easel is thus greatly facilitated. In other respects the enlarger follows the excellent lines of previous models. It has the very efficient chain and sprocket focussing, a movement which, as compared with rack and pinion, is extremely light, perfectly free from back-lash, and permits of one coming much closer to the easel

when focussing the enlargement. The carrier for the negative is now fitted with rise and fall and rotating movement, whilst the whole negative stage itself provides a certain amount of tilt. The lens panel is fitted with rack and pinion adjustment, whilst the lantern body also has chain and sprocket movement. Made in polished



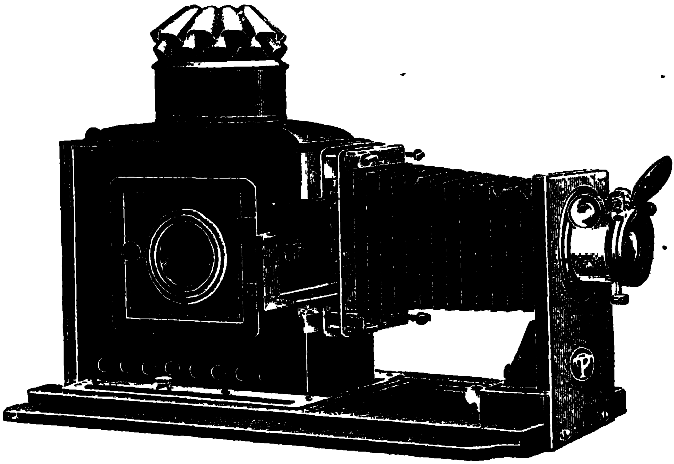
walnut, the price of the quarter-plate enlarger with 5½-inch condenser is £7 without lens, £7 15s. with Petzval lens, and £8 12s. 6d. with Aldis *f*/6 objective. In postcard size these prices are £8 10s., £9 10s., and £10 12s. 6d., and in half-plate, with 8½-inch condenser, £10 5s., £11 10s. and £13 5s.

THE "UNIVERSAL" PROJECTION AND SCIENCE LANTERN.

(Made by the Thornton-Pickard Manufacturing Co., Ltd., Altrincham, Cheshire.)

In the new model of this lantern the front is now of solid woodwork, an improvement on the metal frame of the pattern first introduced. The bellows are detachable for the insertion of small pieces of apparatus, whilst the baseboard is fitted with screws by which the tilt of the lantern can be very nicely adjusted. A further feature is the adjustability of the screws holding the slide carrier: carriers of different thicknesses can be inserted and firmly held in the stage. The lantern as a whole is of very solid build and of handsome appearance. It carries 4-in. double condenser, and can be fitted with projection lens of 6, 8, 10, or 12 ins. as focus desired. Unless otherwise specified, a lens of 6-in. focus is supplied. The price of the instrument is £4 4s., or, complete with telescopic screen and sheet, £7 14s. Full particulars will be found in the company's special catalogue of enlarging lanterns, in which are described the

numerous models of "M.C.C." and "Ruby" enlargers possessing the fullest range of movements and embodying, in the case of every



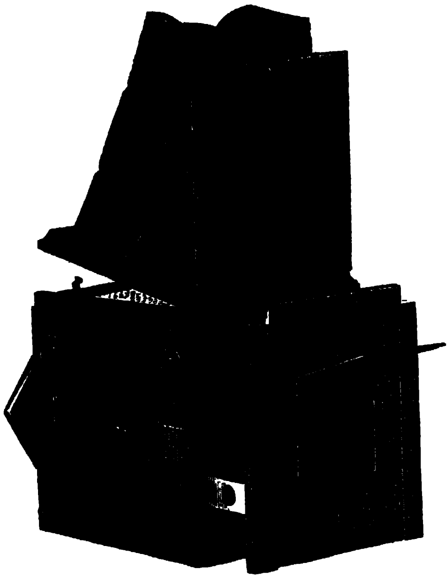
model, the convenient focussing disc, serving for critical focussing of the negative upon the enlarging easel.

"PLANEX" REFLEX CAMERAS, NEW MODELS

(Sold by the City Sale and Exchange, London.)

In last year's "Almanac" we described the leading features of this series of cameras, since when there have been several further improvements, the chief of which is the hinging of the hood frame to the top of the camera so that the ground glass is now instantly accessible for cleaning, and by raising the glass itself the mirror is similarly accessible. As we have many times said, we consider cleaning of the ground glass an important practical feature in a reflex camera, since a dirty focussing screen makes it impossible to be sure of sharp definition. In the shutter of the new model, stops have been provided as a preventive of overwinding, and in its present form the shutter is found to be exceedingly reliable. It is very quickly adjusted for any speed or for time exposures, and in the larger sizes of the camera gives the useful fairly long instantaneous exposures such as a fifth or quarter of a second. Of rigid extension, rack and pinion rise and fall of front, recessed lens-panel with hinged cover which serves as an efficient sky shade, the camera possesses the customary features required of a reflex, including rotating back for horizontal and vertical pictures. The dark-slides are of a very excellent solid pattern of hard, ebonised wood, with aluminium draw-out shutters. With three slides,

but without lens, the price in quarter-plate size is £8 8s., in post card or 5 x 4, £10 10s., and in half-plate £12 12s The "Planex"



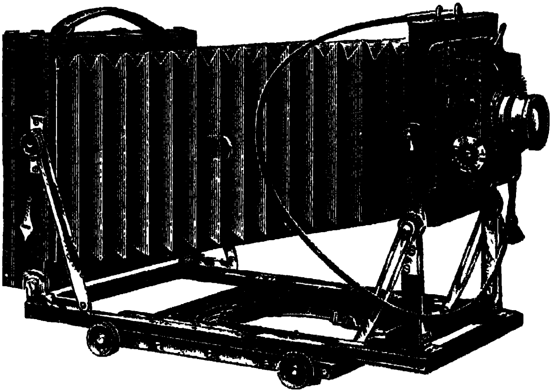
can be fitted with practically any lens, the focal lengths suitable for the sizes given above being 6, 7, and 8¼ inches respectively.

THE "FAIRFIELD" HALF-PLATE CAMERA OUTFIT

(Sold by Hora and Co., 346, York Road, Wandsworth, London, S.W.)

Messrs. Hora send us a new model of the half-plate set supplied by them of British make at the very moderate price of £3 5s complete with *f*/8 R..R lens, three double dark-slides, roller-blind shutter, threefold tripod with sliding leg, the whole in case. The camera possesses all the customary movements. Its full extension from ground glass to lens diaphragm is 22 inches. This is obtained by racking front and back out to about an equal extent, the camera being thus well balanced on the tripod head at the full extension. The back rack movement allows of lenses of the shortest focal length being used. The back has ample swing as well as side swing, great rise of front, both by the movement of the front as a whole on its struts and by raising the lens panel. When it is also said that the

camera has rotating turntable and reversing back it will be seen

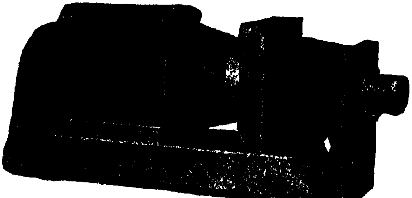


that the makers have omitted no movement which is provided on the most expensive instruments

"ENSIGN" ENLARGING LANTERNS.

(Made by Houghtons, Ltd., 88-89, High Holborn, London, W.C.)

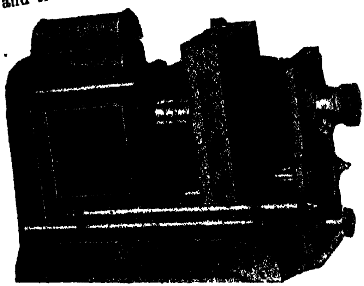
A new series of models of enlarging lantern, made by Messrs. Houghtons in their Walthamstow factories, present a number of interesting features. One new enlarger is the "Popular," an instrument of a simple type issued at the price of £2 17s. 6d. in the



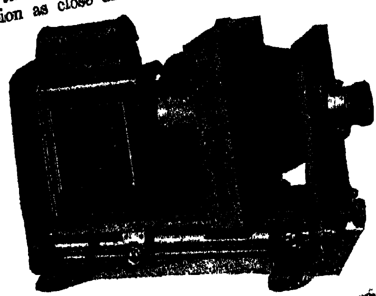
quarter-plate size, complete with 5½-inch condenser and portrait lens. The lantern body is of torpedo shape. The negative carrier has rocking movement, and is fitted with reversible inner carrier. Focussing is by rack and pinion movement of the lens front, as also by the same movement on the lens mount. The lantern body slides to and fro for adjustment of the light.

In more expensive patterns Messrs. Houghtons have dispensed with the rack and pinion adjustment for the extension of the

enlarger front. In its place they use a central large pitch focussing screw operated by a milled head on the front of the enlarger. The latter is guided on brass tubes which slide within larger tubes fixed to the base of the instrument. In the "Princess" model the base is of wood, the tubes being secured to it for the adjustment both of the lens front and the lantern body. The latter is operated by rack



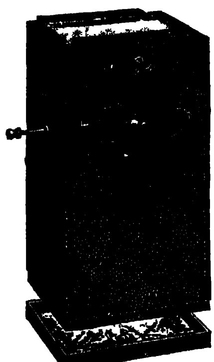
and pinion. The new focussing movement has the advatage of racking the enlarger in and out very quickly and smoothly, whilst in the case of the "Princess" an extra charge of 5s. provides an extension rod to the front focussing pinion by which the worker can take a position as close as necessary to the easel when focussing



the enlargement. The negative carrier is of the usual pattern provided with reversible inner carrier, and with rack adjustment for rotating, raising and lowering the negative. In addition it has a set of four separately adjustable metal masking pieces by which the portion of the negative desired for enlargement can be selected before inserting the carrier into its stage. In the quarter-plate size,

with $5\frac{1}{2}$-inch condenser, the price is £4 17s. 6d. without lens, or £5 12s. 6d. with portrait lens. In 5 x 4 or postcard size these prices are £6 5s and £7 5s., whilst in half-plate they are £7 7s. and £8 12s. 6d.

In the "Premier" enlarger a similar type of construction is adopted, but the base of the instrument is of solid metal standards, grooved to allow of the enlarger being used on rails if desired. A similar quick pitch focussing screw operated from the front is employed, the price of the enlarger, including the extension rod already described. The instrument is also fitted with the negative masks. In quarter-plate the price is £6 5s. without lens; £7 with portrait lens In half-plate these prices are £9 7s. 6d. and £10 12s. 6d.



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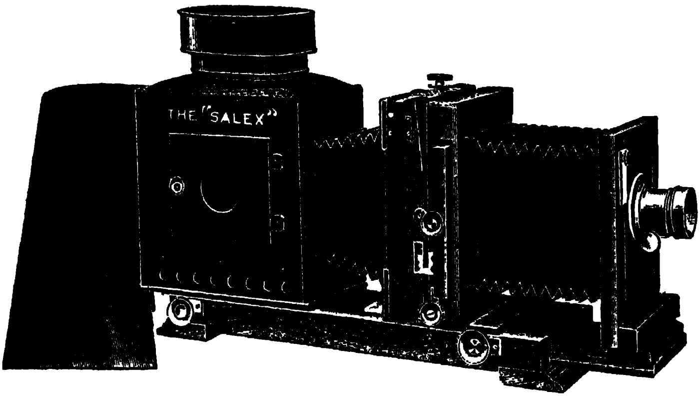
In addition to these enlarging lanterns a new little accessory for the hand-camera worker is a fixed-focus daylight enlarger made in rectangular shape, and thus more convenient to handle than the enlargers of truncated pyramid form which have usually been manufactured. The new pattern of enlarging box is sold in four sizes, all giving an enlargement of postcard size, but differing in the size of negative for which they are made. For vest-pocket (45 x 60 mm.), 3 x 2 inch and $3\frac{1}{4}$ and $2\frac{1}{4}$ inch the price is 7s. 6d. For negatives of $2\frac{1}{4}$ x $1\frac{1}{2}$ inches, 5s. 6d

THE "SALEX NO. 2" ENLARGING LANTERN.

(Sold by the City Sale and Exchange, London.)

In the new model of this enlarger a full range of movements are provided at a price which is exceedingly moderate, the quarter-plate enlarger, without lens, costing £4 2s. 6d. There is ample extension—namely, 17 inches in the postcard size—for making lantern slides or other reduced copies in the enlarger. The negative carrier has rotating movement, and is fitted with carriers to take the smaller sizes of plates; the negative stage as a whole is provided with tilting movement, also by rack and pinion There

is also rack and pinion rise and fall. The adjustment of the position of the lantern body is, again, by rack and pinion, and the body is connected to the main stage of the enlarger by a detachable belows, in the rear frame of which provision is made for insertion of a ground glass diffusing screen for use when necessary, as when working with highly concentrated light or from retouched negatives. The whole apparatus is of polished mahogany with



heavy brass fittings For use as an ordinary optical lantern, a 4¼-inch compound condenser is supplied with a special fitting and a slide carrier at a cost of 14s. 6d. Such special attachment is greatly preferable to the use of the customary condenser when projecting lantern slides, since the loss of light in the latter case is very great. The "Salex" is made in four sizes, quarter-plate, postcard (or 5 x 4), half-plate, and whole plate. With portrait objective the prices are £4 15s , £5 17s. 6d , £7 15s , and £17 5s

DALLMEYER CINEMATOGRAPH TELEPHOTO LENSES.

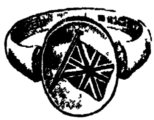
(Made by J H. Dallmeyer, Ltd., Church End Works, Willesden, London, N.W.)

In a new series of lenses great focal length is provided on the telephoto principle without undue camera extension, whilst the aperture is large enough for a very large proportion of cinematograph subjects. In the case of the No. 11 lens the focal length is 12 inches and the camera extension 6 inches, the lens measuring 3¾ inches by 2¼ inches. It is fitted in focussing mount, graduated from 5 yards to infinity. The price is £8 8s. A smaller lens of the series is No. 9, of 6 inches focal length, $f/4.5$ aperture, and requiring 3 inches camera extension, price £7 7s. The No. 10 is of $f/6$ aperture, 8-inch focus and requires 4 inches camera extension, price £7 7s., whilst the No. 12 yields a focal length of 17 inches at 7½ inches extension, and is of $f/6$ aperture. The price is £13 12s.

A PATRIOTIC RING.

(Sold by J. Elliott, Parade Works, Notting .)

A novelty in the shape of photographic jewellery, of which Mr. Elliott supplies a great variety, such as rings, lockets and pendants, is the ring issued under the above title. Its pattern is shown in the drawing. The top of the ring opens, disclosing a tiny photograph, the oval sight opening measuring 5-16th by just over 3-16th inch. The spring cover of the photograph has enamelled upon it a Union

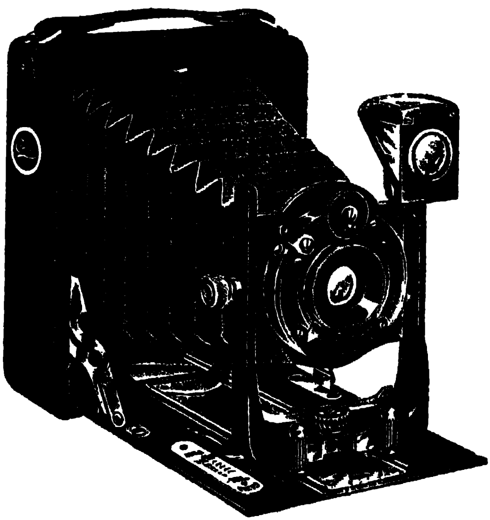


Jack in colours The ring, made in 9-ct gold, is sold at 10s. 9d.

FOLDING PLATE AND FILM CAMERAS.

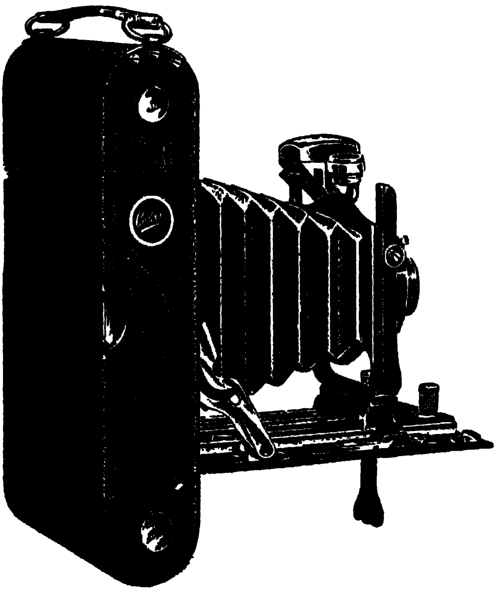
(Sold by W. Butcher and Sons, Ltd., Camera House, Farringdon Avenue, London, E C.)

Several new models of cameras of the popular folding class are new introductions of Messrs Butcher's. The No. 05 "Cameo" is a neat quarter-plate camera for single metal dark-slides. It is fitted with the customary stout U-front with cross movement and ample rack-and-pinion rise of front. The lens, an $f/6.3$ Zeiss "Triotar," is mounted in the "Lukos II." shutter, giving three instantaneous



speeds in addition to "bulb" and "time." Reversible brilliant finder and smooth sliding movement for focussing complete the adjustments of the camera, the finish of which is black leather and metal, with the metal fittings nickelled. A neat and light instrument, costing, with two single metal slides and hooded focussing screen, £4 12s.

Among film cameras of the "Carbine" series a new model is the "Film Back Carbine" for film only, and thus of slimmer dimensions. It is supplied in quarter-plate and postcard sizes fitted with Aldis f/7.7 anastigmat, with "Lukos II." shutter. The camera is of excellent solid yet light build, with large rise and cross movements of the U-form front, focussing scale, reversible brilliant finder and level, and stout bushes for attachment to the tripod head. The whole camera is a very good model of the folding film instrument, and costs £3 5s 6d. in quarter-plate size; postcard, £4 5s.

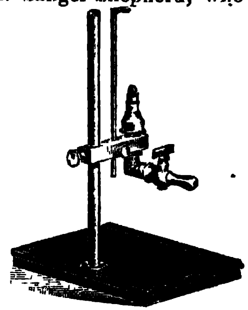


Lastly, we have a very neat new model of the watch-pocket Carbines, the handy little instrument, capable of really good work, and issued at remarkably moderate prices The new model is for film, taking six pictures 3¼ x 2¼. It is fitted with Aldis f/7.7 "Uno" anastigmat in "Lukos II." or "Compound" shutter, reversible brilliant finder, lever focussing movement from infinity to 6 ft., and bushes for attachment to tripod. The bulk of the camera, when folded, is just about 6½ x 3 x 1¼ ins., and the price, with "Lukos" shutter, £3 5s.; with "Compound," £4 10s. Made entirely of metal, the camera is very strong, and when closed is delightfully free from projections.

A STANDARD GAS BURNER.

(Made by Sanger-Shepherd & Co., Ltd., Gray's Inn Passage, Holborn, London, W.C.)

A simple form of gas burner, specially made to give a light either of 1 or 16 candles, is a speciality of Messrs. Sanger-Shepherd, who supply it for the use of photographic workers desiring to make tests of plate-speeds, etc., without the elaborate instruments used in more accurate sensitometric work. The burner is provided with a pointer for adjusting the height of the flame, with spring cap for keeping the burner away from dust when not in use, and with a special form of governor for obviating variations in gas pressure. Mounted on a solid metal stand, the price is £1 10s., either 1 or 16 candle.



A DARK-ROOM WATERPROOF APRON.

(Sold by Lilywhite, Ltd., Halifax.)

An apron of stout waterproof cloth is supplied by Messrs. Lilywhite of size 39 x 34 inches. It is fitted with eyelets for tapes, the cloth at these four points being reinforced with leather. It is an apron which is evidently capable of withstanding an enormous amount of wear. The price is 3s. 9d.

"ACADEMY" AND "INTERMEDIATE" PROJECTION LANTERNS.

(Made by Newton and Co., 72, Wigmore Street, London, W.)

Two new patterns of optical lantern are among the new introductions of Messrs. Newton. The "Academy" is a lantern of moderate price, suitable for use both in small or large halls. The lantern body is supported on brass tubes, the lens front being carried on a second pair of brass tubes sliding within the first, and held in place at any extension by a clamping screw. The extension from the stage to the lens-panel ranges from 3 to 12½ ins. The glasses of the condenser are mounted in separate cells, one or both of which can be instantly removed from the lantern for replacement in case of fracture. The bellows is quickly detachable for the insertion of small pieces of apparatus. Complete with 4-inch condenser and 2-inch projection lens, with double rack and pinion and flashing shutter, the price, inclusive of metal carrying case, but without lamp, is £5 10s.

The "Intermediate" lantern is one particularly suitable for large halls. It is fitted with two brass draw-tubes, and readily gives an extension of 15½ ins. from stage to objective flange. The lantern is fitted on a hollow metal base, whilst other parts are made as lightly as possible, notwithstanding the fact that the instrument, by

its massive front, permits of long-focus lenses being very rigidly mounted. With 4-inch condenser, 2⅜-inch projection lens, and mixed limelight jet, the price is £11 11s., or £13 13s. with hand-feed arc lamp. These prices include convenient wooden case for the outfit.

"SERRAC" AND "CARFAC" LENSES.

(Made by J. H. Dallmeyer, Ltd., Church End Works, Willesden, London, N W)

In the new series of lenses, issued as the "Serrac," Messrs. Dallmeyer secure very fine definition and covering power at the extreme aperture of $f/4.5$. The lens is of the unsymmetrical type, consisting of four glasses, one pair on each side of the diaphragm, but is nevertheless of very small dimensions as regards the length of tube—the 6-inch lens is only 1½ inches long—and thus can be fitted to almost any type of camera. The lens is not of the type in which the separate halves are intended for use separately, but the complete objective yields extremely fine definition, and for the purposes of high-speed photography, press work, and all subjects requiring great rapidity in addition to the other qualities of a lens, it is evidently a most valuable instrument. It is made in six sizes of focal lengths from 4.8 to 8¼ inches, at prices from £4 15s. to £9 15s. in rigid mounts. It is also issued in focussing mounts at prices from £5 10s. to £11, or is fitted with "Compound" shutter, prices £6 15s. to £12 15s.

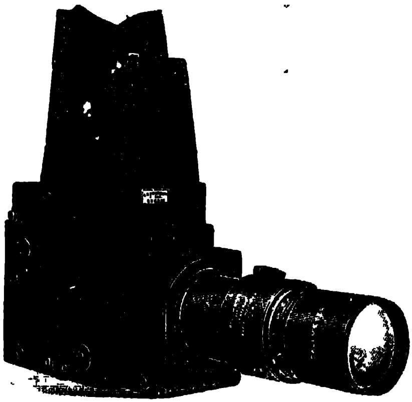
An addition has also been made to the series of "Carfac" lenses in the shape of one of 18 inches focal length and $f/8$ aperture for 15 x 12 plates. The lens is one yielding exceedingly good definition to the corners, and by its focal length and aperture is one very well fitted for large groups. Price in rigid mount, is £18 15s

THE "NATURALIST" REFLEX CAMERA.

(Sold by J. H. Dallmeyer, Ltd., Church End Works, Willesden, London, N.W.)

In the latest model of this camera Messrs Dallmeyer have made a special provision for the use of their "Grandac" rapid telephoto lens by fitting an extension box to the front whereby an extra focal distance of 2½ inches is secured. The full extension from ground glass to lens flange is thus 13 inches. The extension box is fitted with rack and pinion movement for rise and fall of the lens, and space in it is utilised for carrying a pair of focussing magnifiers, which are quickly obtained by opening a small door in the lower part of the box. The "Grandac" lens has, as the positive element, a No. 1a Patent Portrait lens of 10 inches focal length and $f/4$ aperture. In conjunction with the telephoto attachment it affords focal length from 10 to 37 inches, and apertures from $f/4$ to $f/14$. Thus, within the moderate outside dimension of the camera, namely, 9 x 6 x 7½ inches, the nature photographer gets a most useful range of foci. The lens itself measures 9¼ inches x 3¼ inches diameter. In other respects the camera has an excellent focal-plane shutter, working independently of the mirror, rotating back and hood of 8 inches depth. In the quarter-plate, or 9 x 12 cm. size, the price of the outfit, complete

with the No. 1 "Grandac" lens, 6 double slides of solid pattern, film-pack adapter and focussing magnifiers, the whole in solid leather case

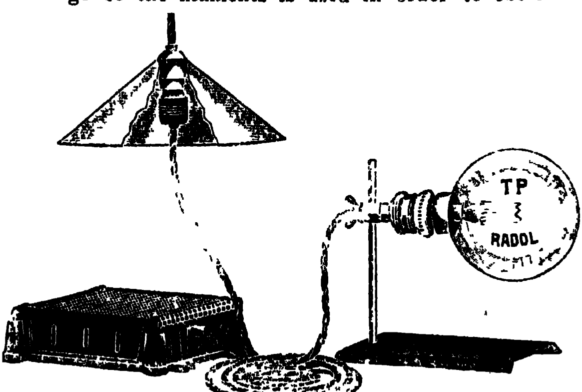


is £42. This includes a spare front enabling the portrait lens to be used alone.

THE "RADOL" ENLARGING AND PROJECTION ELECTRIC LAMP.

(Sold by the Thornton-Pickard Manufacturing Co., Ltd., Altrincham, Cheshire.)

In this metallic filament incandescent electric lamp a special form of assemblage of the filaments is used in order to obtain a con-



centrated focus of light, whilst the globe is sealed off at a point which does not come in the path of the rays to the condenser. The lamp gives a most intense light, ample for all ordinary enlarging

purposes, and sufficient for projection of lantern-slides upon a moderate scale, such as 6 ft. or 8 ft. The lamp is sold complete with tray, support, 6 ft. of flexible cord and plug for connecting to any electric lamp holder. For low voltages, 95 to 135, the price is 25s.; for higher voltages, 30s.

THE "ENSIGN STANDA" ROLL FILM TANK.

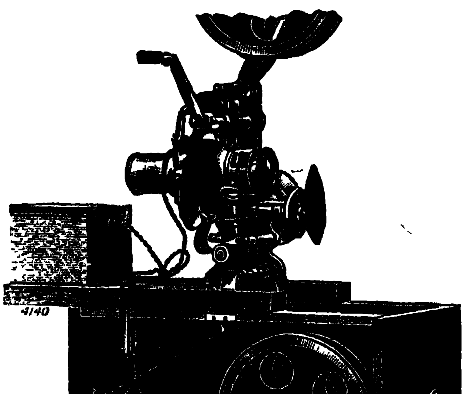
(Sold by Houghtons, Ltd., 88-89, High Holborn, London, W.C.)

In this tank for the daylight development of roll film the film is wound upon a black celluloid apron, a special "container" being used for transferring the film from the spool to the apron. When wound, the "container," with the apron and film in it, is transferred to the tank of developer, in which it can be moved up and down the requisite number of times during development as a preventive of uneven action. The appliance has a capacity of six exposures, and is made in five sizes, for film spools ranging from 2¼ to 7 inches width, at prices from 16s. to 35s.

"ENSIGN" HOME CINEMATOGRAPH.

(Sold by Houghtons, Ltd., 88-89, High Holborn, London, W.C.)

In this cinematograph lantern for home use the source of light is a focus metallic-filament lamp, which can be run either from ordinary house current or from an accumulator. The projector takes the ordinary standard film, which is very easily threaded through the



mechanism. With a picture measuring about 5 ft. a very bright illumination is obtained, and the picture itself is remarkably steady. For running from house supply the price of the outfit is £15; or with 5-ampere accumulator, yielding approximately ten hours' light, £13 5s.

Makers of Photo-Materials and Booklets issued free by them.

Plates (other than Lantern) and Films

Austin Edwards
Cadett
Collis
Criterion
Elliott
Gem
Ilford
Imperial
Kodak
Leto
Lilywhite
Lumière
Marion
Mawson
Paget
Rajar
Wellington
Wratten

Lantern Plates

Cadett
Elliott
Gem
Griffin
Ilford
Imperial
Kodak
Leto
Lumière
Marion
Mawson
Paget
Thomas
Wellington
Wratten

P.O.P., Bromide and Gaslight Papers

Ansco
Any-tone
Cadett
Challenge
Criterion
Elliott
Gem
Gevaert
Griffin
Ilford
Illingworth
Imperial
Kentmere
Kodak
Kosmos
Leto
Lilywhite
Lumière
Marion
Paget
Rajar
Takiris
Wellington

Collodio - Chloride Paper

Gevaert
Ilford
Kodak
Leto
Lilywhite
Lumière
Marion
Paget
Rajar

Self-Toning Papers.

Challenge
Criterion
Elliott
Griffin
Ilford
Illingworth
Imperial
Kentmere
Kodak
Leto
Lilywhite
Paget
Rajar
Wellington

Platinum Papers

Gevaert
Ilford
Kodak
Platinotype Co.

Carbon

Autotype Co.
Elliott
Illingworth
Kentmere

Miscellaneous Printing Papers

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Halden
Marion
Paget

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FORMULÆ FOR THE PRINCIPAL PHOTOGRAPHIC PROCESSES.

ORTHOCHROMATIC PROCESSES.

(Most of the formulæ in this section are those used in the three-colour and process department of the L.C.C. School of Photo-Engraving, Bolt Court, London, E.C., to the Principal of which, Mr. A. J. Bull, we are indebted for assistance in arranging them in the present form.—ED. *B. J. A.*)

Sensitisers for Gelatine Plates.

1.—*For blue-green and green.*

To sensitise up to wave-lengths 5,500 A.U., a good dye is *acridine orange, N.O.* of the Leonhardt Farbwerke, Mulheim, Germany. It is used as directed below for green and yellow sensitising, except that ammonia must not be used.

The isocyanines mentioned below are also extremely good sensitisers for green, and are probably faster, but require suitably adjusted green filters when nothing beyond the green is required.

2.—*For green and yellow, but not red*

To sensitise up to 5,900 A.U., *erythrosine* is still the best dye though it leaves the plates somewhat insensitive to bluish green. The most suitable dye is that of Dr. Schuchardt, Goerlitz, or of Meister Lucius and Bruning, Hoechst, a/M.

One part of dye is dissolved in 1,000 parts of alcohol, and a bathing solution made as follows:—

Stock solution 1 : 1,000	100 parts
Water	400 parts
Ammonia (0·880)	5 parts

This is a 1 : 5,000 solution.

N.B.—Ammonia must not be used with acridine orange.

3.—*Green, yellow and red.*

To sensitise for all rays up to 6,200 to 6,400 A.U. the following are used:—

Orthochrome T, Pinaverdol, Pinachrome, or Homocol,

their order as red-sensitisers being as above.

A stock solution is made containing 1 part of the dye in 1,000 parts alcohol. The bathing solution contains:—

Stock solution	2 parts
Water	100 parts

This is a 1 : 50,000 solution.

The stock solution will keep, but the weaker bath will not. A red light is used, until it is seen that the solution has covered the plates, after which the operation must be continued in total darkness.

4.—*Extreme visible red*

To sensitise for the extreme visible red, *pinacyanol* should be used. The operations can be done in a weak green light, passing the part of the spectrum between 5,000 and 5,300. The dye solutions are prepared exactly as those of Orthochrome T, etc. See above.

5.—*Panchromatic Plates.*

Use a 1-50,000 solution of a mixture of pinachrome and pinacyanol, viz., 3 parts pinachrome stock solution, 2 parts pinacyanol stock solution; water, 250 parts.

6.—*Infra red.*

The best sensitiser for the infra red is *dicyanine*, which is prepared and used exactly as pinacyanol, except that the stock solution must not be added to the water until the very last moment, when everything is quite ready, and the plate can be immediately flowed with the solution, as the weak solution loses its sensitising power very quickly.

If ammonia is used with the cyanine sensitisers given in 3, 4, and 5, it must be quite pure, or fog will be produced. It is best to dispense with it, but if used the proportion is about 1 part per 100 of sensitising bath.

Practical Notes on Bathing.

The dye solution is prepared in a measure, the plates are dusted and laid in a flat porcelain dish, which is large enough to hold nearly twice the number of plates it is desired to sensitise at one time. These are put at one end of the dish; the dish is then tilted, and the dye solution poured into the other (empty) end, then the dish is tilted back, so that the dye solution sweeps over the plates in one even flow free from air bells. The dish is now gently rocked for three minutes, then the plates are removed and washed in a good stream of running water for at least another three minutes. Their sensitiveness and keeping quality will probably be somewhat greater if they are washed for ten minutes, but they will remain good for months, kept under proper conditions, after three minutes' thorough washing, if bathed according to the formulæ given above.

The water tap should be fitted with one of the small anti-splash filters, the fine wire gauze in which retains any solid particles that may be in the water.

After washing, the plate should be well swabbed with a wad of cotton wool, and then placed in a drying cupboard. The quicker drying takes place the better, so that if a current of warmed, filtered air, free from fumes, can be sent through the cupboard it is an advantage, though the absence of this convenience need not deter anyone from sensitising plates. Drying can be hastened by placing a dish of dry calcium chloride or quicklime at the top of the cupboard.

Sensitisers for Collodion Emulsion.

For Green and Greenish Yellow (Hubl).

Pinaverdol (1 : 500)	1 oz.	40 c.c.s.
Collodion emulsion	25 ozs.	1,000 c.c.s.

The sensitiveness extends from the orange to the violet.

Panchromatic Sensitisers (Hubl).

Pinaverdol (1 : 500)	3 ozs.	30 c.c.s.
Ethyl violet (1 . 500)	½ oz.	5 c.c.s.
Collodion emulsion	100 ozs.	1,000 c.c.s.

Pinacyanol can be substituted for ethyl violet.

For Red Sensitising.

Pinacyanol (1 . 1,000)	3 ozs.	3 c.c.s.
Collodion emulsion	100 ozs.	100 c.c.s.

For Blue and (slightly) Blue-green Sensitiveness.

The following sensitiser increases the sensitiveness of the collodion for ordinary work :—

Canary II. (sat. sol.) (Reade Holliday, Huddersfield) ..	1 oz.	10 c.c.s.
Emulsion	10 ozs.	100 c.c.s.

The dyed emulsion keeps well, and in half-tone work gives a sharp, clean dot, but its speed is not improved.

Safe-lights for Developing.

(Newton & Bull.)

Yellow safe light for wet plates, bromide papers.

	Per sq. cm.	Grs. per sq. in. (approx.)
Tartrazine	1 mgm.	$\frac{1}{10}$
Or brilliant yellow	0 5 mgm.	$\frac{1}{20}$
Or naphthol yellow . ..	1 mgm.	$\frac{1}{10}$
Or auramine	2 mgm.	$\frac{1}{8}$

Red safe light for ordinary plates.

	Per sq. cm.	Grs. per sq. in. (approx.)
Tartrazine	1 mgm.	$\frac{1}{10}$
Rose bengal (or fast red) ..	0·5 mgm.	$\frac{1}{20}$

Safe light for Ortho plates.

The above screen is combined with one containing—

Methyl violet	0·5 mgm.	$\frac{1}{20}$

The red screen transmits light from the end of the visible red about λ 7,000 to λ 5,900 in the yellow. The methyl violet absorbs from λ 6,500 to λ 5,000, so that the only light passing the two is the extreme red of λ 7,000 to λ 6,500.

The dyes are dissolved in gelatine solution, which in winter should be about 8 per cent. in strength and about 10 per cent. in summer. About 20 c.c.s. should be allowed for every 100 sq cm. of glass, *i.e.*, about 20 minims per sq. in. The dyes are added, most conveniently from stock solutions, in quantity to give the proportions stated above in the filters.

DEVELOPERS AND DEVELOPMENT.

In this section we give developers for plates, roll and cut films, arranged in alphabetical order.

PROPERTIES OF CHEMICALS IN COMMON USE.

Soda sulphite should be in clear crystals. It should be kept well corked, otherwise the crystals become dull and powdery Such sulphite must be rinsed for a few seconds, in a measure, with enough cold water to cover it, the water poured away and the crystals dried on a clean cloth and weighed out Warm water, not hot or cold, is the best to use. The ordinary form of sulphite (to be used in all formulæ in this book unless otherwise directed) is the "cryst." The "anhydrous" is a stronger variety, 1 part of which is equivalent to about 2 parts of "cryst."

Potass. metabisulphite should be in flattish crystals, with only a little powdery coating on them. Both dry and in solution it keeps much better than sulphite, and goes much further as a preservative It should be well corked.

It must not be dissolved in hot water. Metabisulphite is an acid substance, every grain neutralising 1 grain of soda carbonate cryst., $\frac{1}{2}$ grain of caustic potash, $\frac{1}{3}$ grain caustic soda, or $\frac{7}{10}$ grain dry potass. carbonate.

Soda carbonate, cryst., is best purchased from a photographic dealer: washing soda ("sal soda" in the U S) is a more or less impure

form. The salt loses water in the air, becoming thereby somewhat stronger, and should therefore be kept well corked.

Potass. carbonate should be purchased "dry" and be most securely corked; it absorbs moisture greedily, and if it has been kept for any time should be dried in the oven before weighing out.

Caustic potash.—Purchase as "best stick pure" and keep well corked. Weigh out quickly and handle as little as possible, as it corrodes the skin.

Caustic soda resembles caustic potash, and the same remarks apply.

Note.—In all formulæ the metric weights are not equivalents of the British item for item, but each formula gives a solution of the same composition.

The following are a few of the typical formulæ generally employed for development, etc. —

Amidol.

(*Diamidophenol*)

A normal developer consists of .—

Amidol	2—3 grs.	4 5—7 gms.
Sodium sulphite	25 grs.	57·5 gms.
Water to	1 oz	1,000 c.c.s.

The mixed developer will keep well in solution for about a week, or sometimes longer, if it is made *not stronger* than given above. It must be made up with freshly dissolved sulphite, as this salt does not keep well in solution for more than a few weeks. A sodium sulphite solution that has had added to it some potassium metabisulphite will, however, keep well for a very long period, and by the addition of dry amidol a fresh developer can be rapidly prepared when required Make the following stock neutralised sulphite solution :—

Neutral Stock Sulphite.

Sodium sulphite	4 ozs.	200 gms.
Potassium metabisulphite ..	½ oz.	25 gms.
Water to	20 ozs.	1,000 c.c.s.

It is *best* to boil this mixture after having dissolved the chemicals in moderately hot water. Boiling is not essential, but it improves the keeping qualities of the solution.

Developer.

Amidol	40—60 grs.	2—3 grs.	4 5—7 gms.
Stock sulphite sol.	4 ozs.	100 minims	200 c.c s.
Water to	20 ozs.	1 oz.	1,000 c.c.s.

Amidol is an excellent non-staining developer, giving detail at first and density afterwards. Suitable for plates, papers and lantern-slides.

Azol.

The following are the instructions for the use of this single-solution developer :—

For Plates and Films :—

Normal exposures :	Azol ..	.. 20 mins.	¼ oz.
	Water..	.. to 1 oz.	to 6 ozs.
Under-exposures :	Azol ..	.. 15 mins	¼ oz.
	Water..	.. to 1 oz.	to 8 ozs.
Over-exposures :	Azol ..	.. 30 mins.	¼ oz.
	Water..	.. to 1 oz.	to 4 ozs.

For stand development :—Azol, 1 oz ; water, 100 ozs.

For tank development :—Azol, ¾ oz. ; water, 40 ozs. Time of development of films at 60 deg. F , 20 to 30 minutes. This solution may be used several times in succession.

For lantern slides and transparencies :—Azol, 25 mins. ; potass. bromide 10%, 5 mins., water to 1 oz

For bromide papers :—Azol, 15 mins. ; water to 1 oz. A few drops of 10% solution potass. bromide may be added if the whites are grey.

For gaslight papers .—Azol, 40 mins. water to 1 oz. Add a few drops of 10% solution of potass. bromide, sufficient to keep the whites clear.

Diamidophenol.

See Amidol.

Edinol.

ONE-SOLUTION.

For soft portrait negatives

Sodium sulphite	5 ozs	250 gms.
Edinol	100 grs.	11 gms.
Sodium carbonate..	2 ozs.	100 gms.
Water	20 ozs.	1,000 c.c.s.

For contrasty negatives.

Acetone sulphite (Bayer) ..	288 grs.	33 gms.
Sodium sulphite	4 ozs.	200 gms.
Edinol	100 grs.	11 gms.
Potassium carbonate	2 ozs.	100 gms.
Potassium bromide	50 grs.	5·5 gms.
Water	20 ozs.	1,000 c c.s.

The ingredients should be dissolved strictly in the order given.

Edinol tends to contrast when a carbonate is used : to softness when a caustic alkali is employed. A developer of the latter class contains, in one ounce, edinol, 2½ grs. ; caustic soda, 1½ gr. ; and sodium sulphite, 10 grs.

Eikonogen.

A.—Sodium sulphite	2 ozs.	100 gms.
Eikonogen	½ oz.	25 gms.
Distilled water	20 ozs.	1,000 c c s.

B.—Potass. carbonate ..	.. ..	1½ oz	75 gms.
Distilled water ..	.. ..	20 ozs.	1,000 c.c.s.

For use, mix equal volumes of A. and B.

ONE-SOLUTION.

Sodium sulphite ..	.. ..	2 ozs.	100 gms.
Sodium carbonate	. ..	1 oz.	50 gms.
Distilled water ..	.. ..	20 ozs.	1,000 c.c.s.
Eikonogen ..	.. .. ..	½ oz.	25 gms.

Eikonogen is a good developer for full detail without excessive density in the high-lights

Eikonogen-Hydroquinone.

A.—Hydroquinone ..	.. ..	40 grs.	4 5 gms.
Eikonogen ..	.. .. ..	120 grs.	14 gms.
Sodium sulphite ..	.. ..	480 grs.	55 gms.
Citric acid ..	.. .. ..	20 grs	2·3 gms.
Water to ..	.. .. ..	20 ozs.	1,000 c.c.s.
B.—Potass. bromide ..	.. ..	5 grs	0 5 gms.
Sodium carbonate..	.. ..	60 grs.	7 gms.
Caustic potash ..	.. ..	30 grs.	3·5 gms.
Water to ..	.. .. ..	20 ozs.	1,000 c.c.s

For use, mix in equal parts.

This developer is suitable for negatives, lantern plates, and bromide papers.

Ferrous Oxalate.

This developer is rarely used now: it calls for greater exposure of the plate. But it is unique in the perfectly clear grey stainless negatives which it yields.

A.—Potass. oxalate (neutral), 5 ozs ; hot water, 20 ozs. Cool and pour off clear liquid for use.

B.—Warm water, 20 ozs.; sulphuric acid, 30 minims; sulphate of iron, 5 ozs.

Mix 1 oz. of B. with 3 to 4 ozs. of A (pouring B into A, not *vice versâ*).

A more powerful developer is made by dissolving commercial dry ferrous oxalate in boiling saturated solution of potassium oxalate. As much as will dissolve is stirred in, and the whole left to cool, after which the clear solution is poured off for use.

FOR TRANSPARENCIES ON GELATINO-CHLORIDE PLATES.

A.—Neutral oxalate of potash	..	2 ozs.	100 gms.
Ammonium chloride	.. ..	40 grs.	4·5 gms.
Distilled water ..	.. ..	20 ozs.	1,000 c.c.s.
B.—Sulphate of iron ..	.. ..	4 drs.	34 gms.
Citric acid ..	.. .. ..	2 drs.	17 gms.
Alum ..	.. .. ..	2 drs.	17 gms.
Distilled water ..	.. ..	16 ozs.	1,000 c.c.s.

For black tones, mix the above in equal volume.

HURTER AND DRIFFIELD'S STANDARD FERROUS OXALATE DEVELOPER.

(*The Photographic Journal*, 1898.)

A.—Potassium oxalate	.. ..	1 part
Water	.. ..	4 parts
B.—Ferrous sulphate	.. ..	1 part
Citric acid	.. ..	0·01 part
Water	.. ..	3 parts
C.—Potass. bromide	.. ..	1 part
Water	.. ..	100 parts

For use take A, 100 parts; B, 25 parts; C, 10 parts Development to be conducted at a temperature of 65 deg F.

The ferrous oxalate as compounded above contains in every 1,000 parts:—Potassium oxalate, 185 parts; ferrous sulphate, 68 5 parts: citric acid, 0 61 part; potassium bromide, 0 74 part.

Glycin.

ONE-SOLUTION (HÜBL).

Boiling water	4 ozs.	1,000 c.c.s.
Sodium sulphite	2½ ozs.	625 gms.
When dissolved add—		
Glycin	1 oz.	250 gms.
And then in small quantities—		
Potass. carbonate	5 ozs.	1,250 gms.

This forms a thick cream, which must be well shaken and then diluted with water; for normal work, dilute 1 oz. with 12 or 15 ozs. of water; for very soft results with 30 ozs. of water.

ONE-SOLUTION.

Glycin	1 oz.	33 gms.
Sodium sulphite	2½ ozs.	83 gms.
Potass. carbonate	5 ozs.	166 gms
Water to	30 ozs.	1,000 c.c.s.

For normal exposures dilute with an equal bulk of water.

Glycin is a slow-acting developer which keeps for a very long time and yields negatives perfectly free from stain. It is the best reagent for "Stand Development" (which see).

Hydroquinone.

Made up with soda carbonate (as per the first formula below) hydroquinone is a rather slow-acting developer. The caustic-soda formula is quicker, but easily gives excessive density and contrast; it is best suited for line drawings or subjects where full contrast is required.

ONE-SOLUTION.

Hydroquinone	.. .. ..	100 grs.	11·5 gms.
Sodium sulphite	.. .. ..	1½ oz.	75 gms.
Sodium carbonate	.. .. ..	3 ozs.	150 gms.
Water to	.. ..	20 ozs.	1,000 c.c.s.

May be diluted with an equal volume of water.

This formula is not so quick in action as the next one, but there is less tendency for the great density in the high-lights which is easily produced in cases of under-exposure. In all cases the temperature of the hydroquinone developer should not be allowed to fall below 60 deg., or the solution becomes inert.

TWO-SOLUTION (CAUSTIC SODA).

A.—Hydroquinone	.. .. ..	160 grs.	18 gms
Sodium sulphite	.. .. ..	2 ozs.	100 gms.
Citric acid	.. .. ..	60 grs	7 gms.
Potass. bromide	.. .. ..	40 grs.	4·5 gms.
Water to	.. ..	20 ozs	1,000 c.c.s.
B.—Caustic soda (stick)	.. ..	160 grs.	18 gms.
Water to	.. ..	20 ozs.	1,000 c.c.s.

For use:—A, 1 oz.; B, 1 oz.; water, 2 ozs.

ONE-SOLUTION (WITH FORMALINE).

Hydroquinone	.. .. ..	130 grs.	15 gms.
Sodium sulphite	.. .. ..	6 ozs.	300 gms.
Formaline	.. ..	3 drs.	20 c.c.s
Water to	.. ..	20 ozs	1,000 c.c.s.

A slow developer, giving great clearness in the shadows and plenty of density in high-lights, and specially suitable for line-subjects.

Imogen Sulphite.

A.—Imogen sulphite	.. .. ..	1 oz.	83 gms.
Distilled water (warm)	.. ..	12 ozs.	1,000 c.c.s.
B.—Sodium carbonate	.. ..	1 oz.	500 gms.
Water	.. ..	2 ozs.	1,000 c.c.s.

For correct exposure, A, 2 ozs.; B, 2 ozs.; water, 4 ozs. For under-exposure or soft negatives, A, 1 oz; B, 3 ozs; water, 4 ozs. For over-exposure, A, 2 ozs.; B, 2 ozs.; water, 3 ozs.; potassium bromide, 40 per cent. solution, 1 oz.

Kachin.

A.—Kachin	.. ..	160 grs	9 gms.
Sodium sulphite	.. .. ..	2½ ozs.	62·5 gms.
Water to	.. ..	20 ozs. (fl.)	500 c.c.s.
B.—Sodium carbonate	.. ..	2 ozs.	50 gms.
Water to	.. ..	20 ozs. (fl.)	500 c.c.s.

For use take equal parts of A and B. More diluted developer gives softer results. The solutions should be used at a temperature of 60 to 65 deg. F. Assuming exposure to have been correct, with this

solution the image commences to appear in about one minute, and when full density is required development is completed in from four to six minutes. Softer effects are obtained in from three to four minutes. No restrainer is really necessary, but in the case of over-exposure the use of a few drops of 5 per cent. solution of ordinary borax is recommended.

Kachin is almost free from staining properties, and is excellent in its clean development of stale plates, on which it does not produce the common iridescent markings.

Metol.

ONE-SOLUTION (HAUFF)

Metol	150 grs.	17 gms.
Sodium sulphite	2½ ozs.	125 gms.
Sodium carbonate	3½ ozs.	175 gms.
Potass. bromide	16 grs.	1·8 gms
Water	20 ozs.	1,000 c c s.

In making up all metol developers, dissolve the metol first, then the sulphite, and then the other chemicals, using warm but not hot water.

For portraits, take stock solution, 1 oz.; water, 1 oz. For landscapes, stock solution, 1 oz.; water, 2 ozs.

Metol gives delicate negative with great detail and little density unless development is greatly prolonged. See "Factorial Development."

TWO-SOLUTION (HAUFF).

A.—Metol	150 grs.	17 gms.
Sodium sulphite	2½ ozs.	125 gms.
Water to	20 ozs.	1,000 c.c.s.
B.—Sodium carbonate	3½ ozs.	175 gms.
Potass. bromide	16 grs.	2 gms
Water	20 ozs.	1,000 c.c.s.

For portraits, A, 1 oz.; B, 1 oz. For landscapes, A, 1 oz.; B, 1 oz. water, 1 oz.

ONE-SOLUTION (ANDRESEN).

Metol	160 grs.	18 gms.
Sodium sulphite	3½ ozs.	175 gms.
Potass. carbonate	1¾ oz.	87·5 gms.
Potass. bromide	22 grs.	2·5 gms
Water	20 ozs.	1,000 c.c.s.

For use, take 1 part of developer to 3 of water.

TWO-SOLUTION (ANDRESEN).

A.—Metol	160 grs.	18 gms.
Sodium sulphite	3½ ozs.	175 gms.
Water	20 ozs.	1,000 c.c.s.
B.—Sodium carbonate	3½ ozs.	175 gms.
Water	60 ozs	3,000 c c.s.

One part of A is mixed with 3 parts of B, potass. bromide being added as required for prevention of fogging.

Metol (and other developers) has a poisoning effect on the skin of many persons, causing painful sores and irritation.

The following ointment has a very beneficial effect in such cases.—

Ichthyol	10 grs.
Lanoline	40 grs.
Boric acid	40 grs.
Vaseline	30 grs.

Apply two or three times a day, and rub in well before retiring for the night.

Metol-Hydroquinone.

ONE-SOLUTION.

Metol	35 grs.	4 gms.
Sodium sulphite	2 ozs.	100 gms.
Hydroquinone	50 grs.	5·7 gms.
Sodium carbonate	1½ oz	75 gms.
Water to	20 ozs.	1,000 c.c.s.

This is mixed with an equal volume of water at the time of use.

Dissolve the chemicals in metol-hydroquinone developers, in the order given in the formulæ.

TWO-SOLUTION

A.—Metol	40 grs.	4·5 gms.
Sodium sulphite	120 grs.	14 gms.
Hydroquinone	50 grs.	5·7 gms.
Potass. bromide	15 grs.	1·7 gm.
Water to	20 ozs.	1,000 c.c.s.
B.—Sodium carbonate	½ oz.	25 gms.
Water	20 ozs.	1,000 c.c.s.

Mix in equal parts.

In cold weather it is best to increase the quantity of metol to, say, 60 grs. (6·8 gms.) and reduce the hydroquinone to, say, 30 grs. (3·4 gms.).

Ortol.

ORTOL-SODA.

A.—Ortol	140 grs.	16 gms.
Potass. metabisulphite	70 grs.	8 gms.
Water, cold	20 ozs.	1,000 c.c s.
B.—Sodium carbonate	2½ ozs.	125 gms.
Sodium sulphite	3½ ozs.	175 gms.
Potass. bromide	10 to 20 grs.	1·1 to 2 3 gms.
Water	20 ozs.	1,000 c c s.

100 minims of 1 in 2 hypo solution may be added to solution A, and is said to brighten the shadows, but this addition is of doubtful value.

In cold weather the potassium bromide may be left out.

For quick development take 1 part of A and 1 part of B. For slow and soft development take 1 part of A, 1 part of B, and 1 part water.

Ortol solution should not be made up with sodium sulphite, otherwise red stain may be caused, nor should ammonia be used with it. In other respects it closely resembles pyro.

Paramidophenol.

ONE-SOLUTION.

Potassium metabisulphite	6 ozs.	300 gms.
Distilled water (boiling) ..	20 ozs.	1,000 c.c.s.
Paramidophenol	2 ozs.	100 gms.

Dissolve in the above order and add gradually—

Caustic soda or potash	q.s.

to dissolve the precipitate first formed.

For use, dilute 1 oz. with from 10–30 ounces of water.

Paramidophenol is stainless and keeps well in single solution, owing probably to its preservative action on soda sulphite.

TWO-SOLUTION.

A.—Paramidophenol hydrochloride	200 grs	23 gms.
Potassium metabisulphite	100 grs.	11·5 gms.
Distilled water to.. ..	20 ozs.	1,000 c.c.s.
B.—Sodium sulphite	1¼ oz	62·5 gms.
Potassium carbonate ..	1¼ oz.	62·5 gms.
Distilled water to.. ..		1,000 c.c.s.

For use, mix 1 oz. of A with 2 ozs. of B.

Pyro-Acetone.

A.—Pyro..	1 oz.	100 gms.
Sodium sulphite	4 ozs.	400 gms.
Distilled water to..	9 ozs.	1,000 c.c.s.

Potassium metabisulphite must not be used, unless neutralised, and there should be no addition of citric acid.

A normal developer consists of :—

A. sol (= pyro, 4 grs. or 8 gms)	40 minims	80 c.c.s.
Acetone	40 minims	80 c.c.s.
Water	1 oz.	1,000 c.c s.

and is made by measuring out 40 minims of A solution, adding 40 minims of acetone and making up to 1 oz.

Pyro-Ammonia.

(10% SOLUTIONS.)

A. –Pyro	1 oz	100 gms.
Potass. metabisulphite* . ..	1 oz.	100 gms.
Water to make . ..	9 ozs.	1,000 c.c s.
B.—Potass. bromide	1 oz.	100 gms.
Distilled water to	9 ozs	1,000 c.c.s.
C.—Liquid ammonia (0·880).. ..	1 oz. (fl.)	100 c.c.s.
Distilled water to..	9 ozs.	1,000 c.c.s.

*Or Soda sulphite	4 ozs.	400 gms.

To make a normal developer, take A, 20 minims; B, 10 minims; C, 30 minims; water to 1 oz.; or if no bromide is used, A, 20 minims; C, 10 minims; to water, 1 oz.; or in metric measures, A, 2 c.c.s.; B, 1 c.c.; C, 3 c.c.s.; water to 50 c.c.s.

Pyro-Soda Developer.

(The "B.J." Formula.)

Make up two solutions according to the following formulæ—

A.—Neutral sulphite solution	..	14 ozs.	700 c.c.s
Pyro (sublimed or cryst)	..	160 grs.	18 gms.
Water to make	..	20 ozs.	1,000 c.c s.
B —Soda carbonate	..	4 ozs.	200 gms.
Water to make	..	20 ozs.	1,000 c.c s.

Take A, 1 part: B, 1 part water, 2 parts.

The following is the neutral sulphite solution—

Soda sulphite cryst. ..	..	4 ozs.	200 gms.
Potass. metabisulphite ..	..	½ oz	25 gms.
Water to	..	20 ozs.	1,000 c.c.s.

This solution should be boiled if possible, as the keeping quality of the solution is thereby improved.

This developer will produce negatives free from pyro stain, and 4 to 6 minutes' development at normal temperature with full exposure will yield soft negatives full of detail and well suited to enlarging. The advantages of the developer are its cleanliness and the extraordinary keeping qualities of the A solution.

When stronger negatives are required, the developer can be made up by taking equal parts of A, of B, and of water, or equal parts of A and B alone can be used, this giving a developer containing 4 grains pyro to the ounce.

The mixed solution can be used for several plates in succession if a little extra time is given for development in each case.

It will be noticed that in making up A solution 14 parts of sulphite solution must be added to 6 parts of water, which is equivalent to adding 7 parts to 3. If less sulphite solution is taken, a slightly quicker developer is obtained, but the result will show pyro stain in the lights.

It is as well to use freshly made neutral sulphite solution for making up the A solution if absolute freedom from stain is desired.

The Hurter and Driffield standard pyro-soda developer for plate speed testing is :—

Pyro	..	8 parts.
Sodium carbonate	..	40 parts.
Sodium sulphite	..	40 parts.
Water to	..	1,000 parts.

Pyro-Caustic Soda.

(VALENTA.)

A.—Pyro	.. .. 220 grs.	25 gms.
	Soda sulphite	3½ ozs.	162·5 gms.
	Water to	20 ozs.	1,000 c.c.s.
B.—Caustic potash	.. .. ..	100 grs.	11·5 gms.
	or		
	Caustic soda	70 grs.	8 5 gms.
	Water to	20 ozs.	1,000 c.c.s.

Take A, 1 oz.; B, 1 oz.; water, 1 oz.

The above is a quick-acting and cheap developer, resembling metol in its characteristics.

Pyro-Metol.

A.—Pyro		80 grs.	9·2 gms.
	Metol	70 grs.	8 gms.
	Potass. metabisulphite	180 grs.	20 gms.
	Potass. bromide	30 grs.	3·5 gms
	Water to	20 ozs.	1,000 c.c.s.
B.—Soda carbonate		3 ozs.	150 gms.
	Water to	20 ozs.	1,000 c c.s.

For normal exposures, use equal parts. For under-exposures, increase the proportion of B and add water.

Pyro-metol is a developer which gives both detail and density quickly. The negatives are of slightly greenish-black colour, of good printing quality. An excellent developer for hand-camera exposures.

Pyrocatechin.

TWO-SOLUTION.

A.—Pyrocatechin		175 grs.	20 gms.
	Sodium sulphite	1½ oz.	75 gms.
	Water	20 ozs.	1,000 c.c.s.
B.—Potass. carbonate		2½ ozs.	125 gms.
	Water	20 ozs.	1,000 c.c.s.

Equal parts are mixed together.

ONE-SOLUTION.

Sodium sulphite	5 ozs.	250 gms.
Water	20 ozs.	1,000 c.c.s.
Caustic soda	260 to 300 grs.	30 to 34·5 gms.
Pyrocatechin	400 grs.	46 gms

The chemicals are dissolved in this order, and the stock solution kept well corked. It is diluted with 20 times its volume of water for use.

Rodinal.

Rodinal is a concentrated liquid preparation of para-amido-phenol.

For general work, development of negatives:—Rodinal, 1 oz.; water, 25 ozs. A stronger solution, *e.g.* Rodinal, 1 oz.; water, 10 oz.; can be used to give density in a shorter time

For over-exposures it is convenient to keep the following stock solution :—

Rodinal	1 oz.	30 c.c.s.
Potass. bromide	150 grs.	10 gms.
Water	1 oz	30 c.c.s.

And add a few drops to the 1:30 rodinal developer in cases of over-exposure.

For under-exposures :—Rodinal, 1 oz. : water, 30, 40, or 80 ozs.

Stand Development.

Glycin is a very suitable developer for this purpose, and the following directions are given by Hübl for the use of the formula (given on another page) for a concentrated solution.

Normal developer :—Stock sol., 1 oz. ; water, 80 to 90 ozs.; potass. bromide, 10 per cent. sol., 80 minims.

In this solution a properly exposed plate should make its appearance in 15 or 20 minutes, and obtain full density in several hours.

For under-exposures :—Stock sol., 1 oz ; caustic soda sol. (10%), 1 oz. ; water, 50 oz., warmed to 75 deg. F.

For over-exposures :—Stock sol , 1 oz. ; potass. bromide, 10% sol. 1 oz. ; water, 25 ozs.

Factorial Development.

The total time of development (found by trial to give a certain amount of contrast) divided by the time in which the image first appears is the "factor" of a developer.

The following "Watkins' factors" are abstracted from the instructions from the "Watkins' dark room clock and factoria calculator" :—

SUGGESTED FACTORS.

	Grs. pyro to oz.	Factor.		Grs. pyro to oz.	Grs. brom. to oz.	Factor.
	1	18		1	¼	9
Pyro-soda	2	12	Pyro-soda	2	½	5
without		10	with	3	¾	4½
bromide		8	bromide	4	1	4
		6½			2	3½

Pyro-acetone—about double the above figures

	Factor.		Factor
Adurol (Schering or Hauff)	5	Imogen sulphite ..	6
Amidol (2 grs. per oz.)	18	Imperial pyro-soda	4¾
Diamidophenol ..	60	Imperial Standard (pyro metol)	9
Diogen	12	Kachin	10
Edinol	20	Kodak powders ..	18
Eikonogen	9	Metol	30
Glycin (carb. soda.)	8	Metol-hydroquinone	14
Glycin (carb. potass.)	12	Ortol	10
Hydroquinone (min. bromide)	5	Pyrocatechin ..	10
Hydroquinone (max. bromide)	4½	Quinomet	30
Ilford pyro-soda (maximum pyro)	4½	Rodinal	40
Ilford pyro-soda (minimum pyro)	5½		

Note.—High-factor developers (*e.g.*, metol and rodinal), owing to the long time which is needed for density, tend to softness. Short-factor developers (*e.g.*, hydroquinone and strong pyro-soda) tend to hardness, as they quickly build up density after the image appears.

Where a factor divides evenly into 60, the product is called a divisor, and will greatly facilitate calculating the total time of development. Thus adurol has a divisor of 12 (60 divided by 5), and if the time of appearance in *seconds* is divided by 12 the result is the number of *minutes* to develop.

PYRO-SODA DEVELOPERS.

With and without bromide.

	Factor.		Factor
Austin-Edwards (with B) ..	5	Marion (with B)	4½
Barnet (with B) .	4¾	Mawson (no B) . ..	10
Cadett (no B) .	9	Paget (no B)	11
Kodak (no B) .	12	Thomas (with B)	5
Edwards (with B) .	4½	Wratten (no B)	11
Premier (with B) .	4½	Wellington (normal) ..	11
Gem (with B) .	4	Wellington (studio) ..	15

Combined Development and Fixing.

Although there is not much to be said for simultaneous development and fixing on practical grounds, the following formula may be given as one of the best for the purpose :—

A.—Kachin	.. ..	150 grs.	17 gms.
Sodium sulphite	.. .. ..	3 ozs.	150 gms.
Water to	.. ..	20 ozs.	1,000 c.c.s.
B.—Caustic soda	.. .. ..	160 grs.	18 gms.
Water to	.. ..	20 ozs.	1,000 c.c.s.
C.—Hypo	.. ..	1 oz.	560 gms
Water to	.. ..	2 ozs.	1,000 c.c.s

Take :—A, 160 minims ; B, 24 minims ; C, 20 minims ; water to 1 oz. or, A, 32 c.c s. ; B, 5 c.c.s ; C, 4 c.c.s. ; water to 100 c.c.s.

Restrainers.

Potassium bromide in 10 per cent. solution is the most common restrainer. The dose is from one half-grain (5 minims) per ounce of developer.

Ammonium citrate solution has the advantage that after it has been added to the developer density can be obtained without further fogging, though the development of detail is prevented. An average dose with the pyro-ammonia developer is 6 to 10 grains per ounce (60 to 100 minims of solution made by adding ammonia, about 250 minims, to 1 ounce of citric acid dissolved in a little water until neutral, and diluting the whole to 10 ounces).

Potassium borotartrate.—10 to 30 minims of a 10 per cent. solution restrain with most developers.

Sodium bicarbonate acts as a restrainer, particularly with amidol developer.

FIXING, & HYPO ELIMINATORS.

The Hypo Fixing Bath.

In making up the fixing bath cold water should not be used: the hypo greatly chills the water as it dissolves, and hinders the process There is no harm in using even very hot water if the bath is cold before use.

The average strength of hypo for fixing negatives is 4 ozs. per 20 ozs. It should not be less, but may be more—5, 6 or 8 ozs.

A convenient method of keeping hypo is dissolve each pound in about a pint of water (hot), cool and make up to 32 ozs. in all. Every 2 ozs. of this stock solution equals 1 oz hypo. It is used as follows to make up baths of various strength:—

Hypo, required per 20 ozs of fixing bath.		Mix, of stock solution,		Water.	
8 ozs.	..	16	with	4	*i.e*, stock, 4; water, 1
6 ozs.	..	12	with	8	*i.e.*, stock, 3; water, 2
5 ozs.	..	10	with	10	*i.e.*, equal parts.
4 ozs.	..	8	with	12	*i.e.*, stock, 2; water, 3.
3 ozs.	..	6	with	14	*i.e.*, stock, 3, water, 7.
2 ozs.	..	4	with	16	*i.e.*, stock, 1; water, 4.

In fixing plates, observe three golden rules:—

1.—Let plates remain in fixer as long again as it takes for the white emulsion to dissolve away.

2.—Always rinse fingers under tap or in a dish of water after touching hypo, not simply wipe on a towel.

3.—Avoid letting hypo droppings dry up on table or floor. If hypo solution drops or is splashed or spilt about the dark room mop it up with a floor cloth and leave all clean.

Acid Fixing Baths.

Hypo	.. ..	4 to 6 ozs.	200 to 300 gms.
Potass. metabisulphite	.. ..	½ oz.	25 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

The metabisulphite should be added only when the hypo solution is cool or tepid—not when it is hot.

This is the best formula we know for an acid fixing bath for plates or papers. It keeps clear and stainless to the last, and does not throw down sulphur with use.

The following is a cheaper bath:—

Hypo solution (1:5)	.. ..	50 ozs.	1,000 c.c.s.

To which add a mixture of—

Tartaric acid solution (1:2)	..	1½ oz.	30 c.c.s.
Sodium sulphite solution (1:4)		3½ ozs.	70 c.c.s.

Alum-Hypo Fixing Bath.

Alum (saturated solution) ..	20 ozs.	1 000 c.c.s.
Sodium sulphite (saturated solution)	4—7 ozs.	200-300 c.c.s.
Hypo-solution (1.5) .. .	20—28 ozs.	1,000-1,250 c.c.s.

Chrome Alum and Hypo Fixing Bath.

Add—		
Strong sulphuric acid	2 dr. (fl)	10 c.c s.
Water	2 ozs.	80 c.c.s.
to—		
Sodium sulphite	2 ozs.	80 gms.
Water	6 ozs.	240 c.c.s.
And pour the mixture into—		
Hypo	16 ozs.	700 gms.
Water	48 ozs.	2,000 c c.s.
Finally add to the above mixture—		
Chrome alum	1 oz	40 gms
Water	8 ozs.	300 c.c.s.

Removing Hypo by Washing.

In washing negatives in running water or frequent changes, over 90 per cent. of the hypo is cleared away in less than ten minutes. To remove the remainder, by a washer or hand method, it is essential to drain off *all* the water in which the negative has soaked. The best washers are those which alternately empty and refill, and the same principle should be followed when washing in dishes. If this is done, there is no need to wash negatives longer than an hour at the outside.

Hypo-eliminators are chemicals which convert the hypo into some other substance, but as it is not certain into what, this chemical method of removing hypo is not so reliable as removal by washing. But we give three formulæ.

Hypo-Eliminators.

Permanganate.

Wash the negative for one minute under the tap, and transfer to a shallow dish containing water with enough potass. permanganate in it to turn it pink. Remove the negative as soon as the colour goes (which will be in a second or two if hypo is present), and keep on treating in the very weak permanganate baths until the colour is not discharged. The water itself will destroy the permanganate colour, but not quickly as hypo does. A very cheap and satisfactory process which allows of a negative being ready for drying within three minutes of fixation.

Persulphate.

Ammonium persulphate	2½ grs.	6 gms.
Carbonate of soda..	5 grs	12 gms.
Water	1 oz.	1,000 c.c.s

PERCARBONATE.

Potassium percarbonate	$2\frac{1}{2}$ grs.	6 gms.
Water	1 oz.	1,000 c.c.s.

Rapid Drying of Negatives.

Method I.—Rinse from the hypo-bath, place in 1 : 50 formaline for ten minutes, wash by pouring nearly boiling water six times over the negative and dry by heat. To get rid of the relief which is produced by this process the negative is rubbed with a piece of wash-leather moistened with alcohol.

Method II.—After washing in the usual way or using a hypo-eliminator, lay a piece of old fine cambric on the negative and firmly pass a roller squeegee over it The negative, with much of the water thus removed, will dry in a few minutes in a moderately warm place.

Method III.—Soak in two successive baths of methylated spirit, and place in a current of air. The present commercial spirit, owing to the mineral naphtha in it, causes a whitish scum on the surface of the film, and is not favourable to clean work.

Method IV.—Electric hot blast—by means of a blower of the kind used by hairdressers, and capable of giving a temperature of from 68° to 125° F., within from 4 to 6 minutes, according to the distance of the blower from the rack of negatives—3 ft. to 1 ft

HARDENING AND CLEARING SOLUTIONS.

As a general rule, there is no need to use a bath of alum ; frilling or softening of the films of plates is seldom met with—that is, in temperate latitudes. When it does occur, it is most usually the result of baths (developing, fixing, etc.) being of very different strengths or at *different* temperatures.

If a plate *should* show signs of frilling in the developer, it should be rinsed for an instant and placed in one of the hardening baths, given below, then washed for ten minutes before fixing. This is better than hardening *after* fixing.

Hardening Baths.

Formaline	1 oz fluid.	50 c.c.s.
Water	10 to 20 ozs.	500-1,000 c.c.s.
Alum	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.
Chrome alum	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.

Whichever bath is used, allow it to act for 15 or 20 minutes.

In making up the chrome alum bath, use cold or warm, not hot, water.

Clearing Solutions.

Acid Alum.

Alum	2 ozs.	200 gms.
Citric acid	1 oz.	100 gms.
Water	10 ozs.	1,000 c.c.s.

Wash well after fixing, and immerse the negative in the above. This bath is also useful for removing white scum from negatives developed with ferrous oxalate if rubbed on with cotton wool.

Chrome Alum.

Chrome alum	½ oz.	25 gms.
Hydrochloric acid..	½ oz	25 c.c.s.
or		
Citric acid	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.

We prefer this latter bath for the final treatment of negatives, and for obtaining a clean smooth film.

Thiocarbamide.

Thiocarbamide	90 grs.	10 gms.
Citric acid	90 grs.	10 gms.
Water	20 ozs.	1,000 c.c.s.

Sodium Hypochlorite.

(*Eau de Javelle.*)

This bath need only be resorted to in cases of severe stain, particularly on old negatives.

Bleaching powder..	1 oz.	30 gms.
Sodium carbonate..	1½ oz.	45 gms.

Shake up the bleaching powder with a solution of the carbonate in a little water (6 ozs. or 180 c.c.s), and filter. Extract the residue with plain water, and again filter. The filtrate (solution of sodium hypochlorite) forms an active stain remover. It can be acidified with oxalic acid, and then discharges yellow stain still more vigorously, but with risk to the silver image.

N.B.—In either state (alkaline or acid) the solution has a strong softening action on gelatine. Plates should not be left to soak longer than necessary—which should be 10 to 15 minutes as a rule.

Removing Silver Stains.

Most silver stains (due to dampness of paper or negative while the two are in contact) will readily yield to the following simple treatment first suggested by Mr. Harold Baker :—

Rub the dry negative with Globe metal polish (or other similar abrading preparation) for a minute or two. This is done by applying the polishing paste on a tuft of cotton wool Then place negative in very strong hypo solution. Here the stain disappears: the time may be minutes or hours according to the depth and age of the stain.

In very severe cases the following method may be necessary --
Soak the negative in—

A.—Potass. iodide	200 grs.	45 gms.
Water	10 ozs.	1,000 c.c s.

and after washing transfer to—

B.—Potass. cyanide	300 grs.	70 gms.
Water	10 ozs.	1,000 c c s.

in which rub the stained part of the film with a pledget of cotton wool.

If the stain does not yield to this treatment a solution of iodine (in potass. iodide) may be used in place of solution A.

NEGATIVE INTENSIFIERS.

Negatives which are too thin (and as a rule yield flat prints) may be greatly improved by intensification.

If the negative is thin through under-exposure, that is, has not attained good density even on long development, the best intensifier is the uranium. For this, as for most intensifiers, the plate should be both thoroughly fixed and washed—one is as important as the other.

If the plate is simply under-developed—clear and bright, but thin—the chromium or the mercury and ferrous oxalate intensifier (applied more than once if necessary) or the Wellington silver intensifier is very suitable. If the plate is over-exposed, thin but veiled and flat, the mercury and ammonia intensifier is a good remedy; or it may be well first to reduce carefully with Farmer's reducer, and then (after a second thorough wash) to intensify with chromium, mercury and ferrous oxalate, Wellington, or, if plate is very flat, with Monckhoven's or the mercury and ammonia formula. The copper and lead intensifiers give great density, and are suited only for negatives of line drawings, etc., in which great general opacity and, at the same time, great clearness of the lines are required.

Mercury Intensification.

The negative is bleached in the following saturated solution of mercury bichloride:—

Mercury bichloride (corrosive sublimate)	1 oz.	62 gms.
Hot water	16 ozs.	1,000 c.c s.

After cooling this solution and pouring off from the white feathery crystals thrown down, add—

Hydrochloric acid..	30 minims	4 c.c.s.

After *well washing*, the bleached negative is blackened in one or other of the following:—

A.—Ammonia (0 880) ..	.. ..	20 drops	20 drops
Water	.. ..	1 oz.	30 c.c.s.

Gives great intensification and good black colour.

B.—Soda sulphite, 10 per cent. solution, made slightly acid with citric acid. Very slightly strengthens a negative.

C.—An alkaline developer, such as pyro-soda, pyro-ammonia, hydroquinone. Gives about double the intensification of B.

D.—Schlippe's salt ..	.. ..	200-400 grs.	20-40 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

This solution must be made fresh, and gives great intensification.

E.—Ferrous oxalate developer, made as directed under "Developers." This process can be repeated as many times as desired, and gives absolutely permanent results: it deals evenly throughout with the tones in the negative.

Monckhoven's.

A.—Bromide of potassium	10 grs.	23 gms.
Bichloride of mercury	10 grs.	23 gms.
Water	1 oz.	1,000 c.c.s.
B.—Pure cyanide of potassium ..	10 grs	23 gms.
Nitrate of silver	10 grs.	23 gms.
Water	1 oz.	1,000 c.c.s.

The silver and cyanide are dissolved in separate lots of water, and the former added to the latter until a permanent precipitate is produced. The mixture is allowed to stand 15 minutes, and, after filtering, forms Solution B

Place the negative in A till it is white, then rinse and transfer it to Solution B. If the intensification has been carried too far, it may be reduced by treatment with a weak solution of hyposulphite of soda.

Mercuric Iodide.

Water	20 ozs.	1,000 c.c.s.
Sodium sulphite	4 ozs.	200 gms.
Mercuric iodide	90 grs	10 gms

The sulphite must be dissolved first. The solution keeps well in the dark.

This is a very convenient intensifier, as plates need only be rinsed for a few minutes in water on coming out of the hypo bath to be ready for intensification.

When intensified they are simply washed for a few minutes; the negative is then liable to yellow in time, but if plate is placed for a few minutes in any non-staining developer the results are quite permanent.

If mercuric iodide is not available the following may be used :—

Mercuric chloride..	50 grs.	6 gms.
Water	10 ozs.	500 c c.s.

Add 10 per cent. potass. iodide solution until precipitate first formed is redissolved. About 1¼ oz. (75 c.c.s) will be required, and when clear, add—

Sodium sulphite	4 ozs.	200 gms.
Water to make	20 ozs.	1,000 c.c.s.

Silver Intensifiers.

J. B. B. Wellington's Formula (1911).

First harden the film in :—Formaline, 1 part; water, 10 parts, for five minutes. Rinse for a few minutes, and then place for *exactly one minute* in :—

I.—Potass, ferricyanide	20 grs.	2·3 gms.
Potass. bromide	20 grs.	2 3 gms.
Water	20 ozs.	1,000 c.c.s.

This causes no apparent change in the negative ; if used too long it will bleach the negative and alter its gradation. Rinse again for a few minutes and intensify.

Stock Solutions.

A.—Silver nitrate	800 grs.	91·2 gms.
Water, distilled, to	20 ozs.	1,000 c.c.s.
B.—Ammonium sulphocyanide ..	1,400 grs.	160 gms.
Hypo	1,400 grs.	160 gms.
Water to	20 ozs	1,000 c.c.s.

Take A, ½ oz., and add slowly to ½ oz. B, stirring vigorously (mixture should be clear) ; then add 10 % pyro solution, (preserved with sulphite) 1 dram, and 10 % ammonia solution, 2 drams.

Place negative in chemically clean dish, best of glass, and pour solution over it. Silver begins to deposit in a minute or two. When intensified enough, place in acid fixer and well wash. Flat negatives may be over-intensified and then treated with Farmer's reducer.

Acid Silver.

A.—Pyro..	15 grs.	3·5 gms.
Citric acid	5-10 grs.	1-2 gms.
Water	10 ozs.	1,000 c.c.s
B.—Silver nitrate	10 grs.	23 gms.
Water to	1 oz.	1,000 c.c.s.

About 1 oz. (30 c c.s) of A is poured over the plate once or twice, about 15 drops of B solution added, and the mixture again applied. Intensification now takes place and the solution is poured off and on until sufficient. If intensifier becomes very thick and turbid, fresh should be mixed up. When dense enough the negative is rinsed, fixed and washed. Negatives (on gelatine plates) are best hardened with alum or formaline before using this intensifier, otherwise it is difficult to avoid stains.

Chromium Intensifier.

(C. Welborne Piper.)

An excellent and convenient intensifier for general work Results permanent.

	A.	B.	C.
Potassium bichromate ..	5 grs.	10 grs.	10 grs.
Hydrochloric acid (sp. gr., 1 160)*	1 minim	5 minims	20 minims
Water	1 oz.	1 oz.	1 oz.

Bleach in A, B or C solution, wash until yellow stain is removed, and then develop (by daylight, or after exposure to daylight) with amidol

A gives intensification about equal to mercury and ammonia; B, to that of mercury and ferrous oxalate; and C, to that of mercury and sodium sulphite.

The process may be safely applied after fixation if the plate is simply rinsed for a minute or so.

It may be repeated several times if the first application does not give enough density.

Copper Intensifier.

Gives great intensification and is best suited for line subjects.

A.—Copper sulphate	100 grs.	230 gms.
Water	1 oz.	1,000 c.c.s.
B.—Potass. bromide	100 grs.	230 gms.
Water to	1 oz.	1,000 c.c.s.

A and B are separately made up with hot water, mixed, and allowed to cool. The negative is bleached in the mixture, and washed for a minute or two. It is then blackened in:—

Silver nitrate	45 grs.	100 gms.
Water (distilled)	1 oz.	1,000 c.c.s.

For still greater density, the negative is well washed from silver, and an ordinary developer applied

If too dense, after the silver, it can be placed in weak hypo solution (about 10 grs. per oz.) or weak potass. cyanide (about 2 grs per oz.).

Lead Intensifier.

Lead nitrate	400 grs.	46 gms.
Potass. ferricyanide	600 grs.	70 gms.
Acetic acid	3 drachms	20 c.c.s.
Water to	20 ozs.	1,000 c.c.s.

This stock solution will keep for a long time in the dark. The negative is bleached in it, washed once *very carefully* in 10 per cent. nitric acid—the acid makes the film very tender—then in water, and then darkened in:—

A.—Sodium sulphide	1 oz.	50 gms
Water	20 ozs.	1,000 c.c.s.

* "Commercial pure" strong acid.

Or in—

B.—Schlippe's salt	.. .. ..	90 grs.	10 gms.
Ammonia (0·880)	.. .. ..	6 drachms	40 c.c.s.
Water	.. ..	20 ozs.	1,000 c.c.s.

Or in—

C.—Potass. bichromate	.. ..	1 oz.	100 gms.
Ammonia (0 880)	.. .. ..	½ oz.	50 c.c.s.
Water	.. ..	10 ozs.	1,000 c.c.s.

The lead intensifier gives very great intensification, and is suited only for line-subjects.

Uranium Intensifier.

A.—Uranium nitrate	.. .. ..	100 grs.	23 gms
Water	.. ..	10 ozs.	1,000 c.c.s.
B.—Potass. ferricyanide	.. ..	100 grs.	23 gms.
Water	.. ..	10 ozs.	1,000 c.c.s.

The intensifier is prepared from.—A sol., 1 oz ; B sol., 1 oz. ; acetic acid, 2 drachms.

The plate must be perfectly free from hypo, and after intensification be washed in several changes of *still* water until the yellow stain is gone. A 10 gr. per oz. solution of ammonium sulphocyanide removes any yellow stain, and weak ammonia or sodium carbonate removes the intensification altogether, restoring the negative to its original state. A weak acetic acid bath should then be applied to the negative if the intensifier is to be again applied.

NEGATIVE REDUCERS.

Reduction is useful if the negative is so dense (black) that it takes long to print. Also, apart from reducing time of printing, reduction is used to improve the gradation of negatives.

For those which are too hard, usually as the result of under-exposure and too long development, the best reducer is the persulphate. The permanganate and bichromate are similar in their effect.

For those which, though dense, yield prints which are too flat—this is the result of great over-exposure and long development—the best is Farmer's. Belitski's is similar.

Even when density is not excessive, it is usually well, in the case of flat negatives, to reduce a little in "Farmer's," and then intensify.

The other reducers—Eder's, iodine-cyanide, and ceric sulphate—are used chiefly when it is desired somewhat to reduce negatives of good gradation.

Farmer's.

This reducer tends to remove detail in the shadows whilst leaving untouched the dense high-lights. Hence it increases contrast: "brightens up" a negative.

Hypo solution (1 : 5)	5 ozs.	150 c.c s.
Potass. ferricyanide (10% sol.) ..	quant. suff.	quant. suff.

The colour is a fair indication of the strength of the reducer, it should be pale yellow, not orange, and should be used weak rather than strong, since its selective action on the shadows of a negative is then less.

Yellow stain is due usually to the use of an acid fixing bath, or an old fixing bath, instead of clean plain hypo solution. It is not easy to remove.

If the reduction is required as "even" as possible, that is, less pronounced on the shadows of the subject in the negative, use the reducer very weak, viz.: largely diluted with water.

Where the extreme of contrast is required, use a strong reducer, applying it with cotton wool, not too wet with reducer. Very useful for line negatives, where quite clear lines on a dense ground are wanted.

Belitski's.

Potass. ferric oxalate	150 grs.	10 gms.
Sodium sulphite	125 grs.	8 gms.
Water..	7 ozs.	200 c.c s.

Dissolve and add—

Oxalic acid..	40 to 45 grs.	2·5 to 3·1 gms.

and shake until the solution turns green. Then pour off from undissolved crystals and add—

Hypo	1¾ oz.	50 gms.

Instead of the ferric oxalate the following more easily obtainable chemicals can be used in the formula.—

Ferric chloride cryst.	100 grs.	6 5 gms.
Potass. oxalate	190 grs.	12·5 gms.

This reducer is stainless, and keeps well in the dark. Its action on the shadow detail of the negative is similar to that of Farmer's.

Persulphate.

Ammonium persulphate.. ..	10 to 20 grs.	23 to 45 gms.
Water	1 oz.	1,000 c.c.s.

A fresh solution is made at time of use. A drop of sulphuric acid per 2 ozs. makes the action more regular. It is best also to use the reducer before the negative has dried.

When sufficiently reduced—indeed, slightly before—the negative is placed at once into 5 per cent sodium sulphite solution.

If much reduction has taken place it is well to fix a second time. The persulphate reducer acts first on the heavy high-light densities of the negatives, reducing these without affecting shadow detail. It thus "softens" a hard negative.

Eder's (Mercury and Cyanide).

Potassium cyanide	20 grs.	5 gms.
Potassium iodide	10 grs.	2 gms.
Mercury bichloride	10 grs.	2 gms.
Water	10 ozs.	1,000 c.c.s.

Dissolve the mercury, then the iodide, and lastly the cyanide to dissolve the red precipitate formed. The solution reduces slowly, and is non-staining and intensely poisonous.

Iodine-Cyanide.

Iodine (10 per cent. sol. in potass. iodide sol.)	30 minims	6 c.c.s.
Potass. cyanide (10 per cent. sol. in water)..	5 minims	1 c.c.s.
Water	1 oz.	100 c.c.s.

A very clean-acting (but intensely poisonous) reducer. Very suitable, when used quite weak, for bromide prints, as it leaves no stain.

Ceric Sulphate.

Sulphuric acid (sp gr 1·84) ..	20 minims	4 c.c.s.
Water	2 ozs.	200 c.c.s.
Dissolve in this—		
Ceric sulphate	2 ozs.	100 gms.
And dilute to—		
Water	10 ozs.	1,000 c c.s.

Hard negatives are placed wet in a mixture of this stock solution and nine times its volume of water. Reduces contrasts. Over-exposed, long-developed negatives are dipped dry into a mixture of stock solution and an equal part of water and carefully watched as the action is very rapid. A convenient form of the reducer is the stock solution sold by Lumière.

Permanganate.

Potass. permanganate, 10% solution	1 dr.	10 c.c s.
Sulphuric acid (10% solution by volume of 1·84 acid)	5 drs.	50 c.c.s.
Water	10 ozs.	1,000 c.c.s.

Applied to a wet negative, gives even reduction. A dry negative receives greater reduction in the high-lights, and great softening may be obtained by immersing dry negative quickly in the reducer, washing immediately, drying and re-immersing. Any brown stains are removed with a 10% solution of sodium sulphite containing 2% oxalic acid.

Bichromate.

Potass. bichromate	100 grs.	20 gms.
Sulphuric acid	7 drs. (fl.)	40 c.c.s.
Water	20 ozs.	1,000 c c.s.

Hypochlor and Alum.

Chrome alum	10 grs.	4 gms.
Eau de Javelle	½ oz.	100 c.c.s.
(See "Clearing Solutions")		
Water to make	5 ozs.	1,000 c.c.s.

Immerse the negative and gently rub the surface with a piece of cotton wool. By confining friction with the wool to certain parts, extra reduction can be obtained.

Reducing Hard Negatives.

A most valuable and perfectly safe method of reducing excessively hard negatives is one dependent on re-development. Bleach the negative first in a solution of ferricyanide and potassium bromide, using the same bath as is commonly employed for sulphide toning. After a thorough wash re-develop in a developer containing 2 per cent. of rodinal and 1 per cent. of potassium bromide—that is, one containing 1 dram of rodinal and 5 drams of 10 per cent. bromide solution in 6 ozs. of water. Development will be very slow, but the plate may be left to itself for half an hour or so, as the action cannot go too far When development is sufficient the plate is fixed, washed, and dried.

Baskett's (Local) Reducer.

It consists of—

Globe metal polish	2d. tin
Terebene	2 ozs.
Salad oil	2 ozs.

The ingredients are to be well mixed, and strained through fine muslin two or three times to remove any coarse particles. Dense parts of a negative are rubbed down with the reducer applied by the finger-tip or with a bit of chamois leather.

NEGATIVE VARNISHES.

Hot Varnishes.

No. 1.—	Sandarac..	4 ozs.	113 gms.
	Alcohol	28 ozs	800 c.c.s.
	Oil of lavender	3 ozs.	85 c c s.

This is a good varnish for retouching upon, and a tooth is easily obtained by rubbing.

No. 2.—	Seed lac	2 ozs.	50 gms.
	Sandarac..	2 ozs.	50 gms.
	Oil of lavender	½ oz.	12·5 gms.
	Castor oil	1 oz.	25 c.c.s.
	Alcohol	40 ozs.	1,000 c.c.s.

To prepare a good surface for the retouching pencil, the negative after varnishing is dusted over with fine resin powder and rubbed up with the fingers.

No. 3.—White hard varnish	.. ..	15 ozs	150 c.c.s.
Rectified spirit (not methylated spirit)	.. ..	20 to 30 ozs.	200 to 300 c.c.s.

This will be found a good and cheap varnish if durability is not required, as it is easily rubbed up for retouching upon and easily cleaned off. Very suitable for enlarged negatives that are not to be retained.

No. 4.—Bleached shellac	.. ..	1¼ ozs.	62 gms.
Mastic	.. ..	¼ oz.	13 gms.
Oil of turpentine	.. ..	¼ oz.	13 c.c.s.
Sandarac	.. ..	1¼ oz.	62 gms.
Alcohol	.. ..	20 ozs. (fl.)	1,000 c.c.s.

Tough, hard, and durable.

No. 5.—Sandarac	.. ..	80 ozs.	160 gms.
Turpentine	.. .. ..	36 ozs	72 c.c.s.
Oil of lavender	.. .. ..	10 ozs.	20 c.c.s.
Alcohol	.. ..	500 ozs.	1,000 c.c.s.

This one may also be rubbed down with powdered resin, and gives a splendid surface for retouching.

No. 6.—Sandarac	.. .. ..	1 oz.	55 gms.
Seed lac	.. ..	1½ oz.	83 gms.
Castor oil	.. .. ..	3 drs.	20 c.c.s
Oil of lavender	.. .. ..	1½ dr.	10 c.c.s.
Alcohol	.. ..	18 ozs (fl.)	1,000 c.c.s.

This varnish is somewhat dark in colour.

No. 7.—Best orange shellac	.. ..	2½ ozs.	125 gms.
Oil of lavender or oil of turpentine	.. ..	¼ oz.	13 c.c.s.
Methylated alcohol	.. ..	20 ozs	1,000 c.c.s.

Keep in a warm place until dissolved; then add a large teaspoonful of whiting or prepared chalk; shake, set aside to clear, and then decant. This is specially recommended for gelatine negatives.

Cold Varnishes.

No. 1.—Celluloid	.. ..	1 oz	10 gms.
Amyl acetate	.. .. ..	50 ozs.	500 c.c.s.

To counteract the sickly odour of amyl acetate, add a small proportion of oil of lavender.

This may be flowed over or applied with a brush to the cold negative.

No. 2.—Zanzibar copal	.. .. ..	6 ozs.	30 gms.
Amber (fused)	.. .. ..	1 oz.	5 gms.
Ether	.. ..	60 ozs.	300 c.c.s.
Acetone	.. ..	40 ozs.	200 c.c.s.
Chloroform	.. .. ..	4 ozs.	20 c.c.s.

No. 3.—20% shellac solution	.. ..	2 ozs.	160 c.c.s.
Ammonia (0·880)	.. ..	3 drs.	30 c.c.s.
Methylated spirit	.. ..	4 ozs	320 c.c.s.

No. 4.—A mixture of Japanese gold size (1 part) and benzole (2 parts) forms a rather slow-drying though otherwise excellent cold varnish. The surface takes the pencil well.

SHELLAC WATER VARNISH.

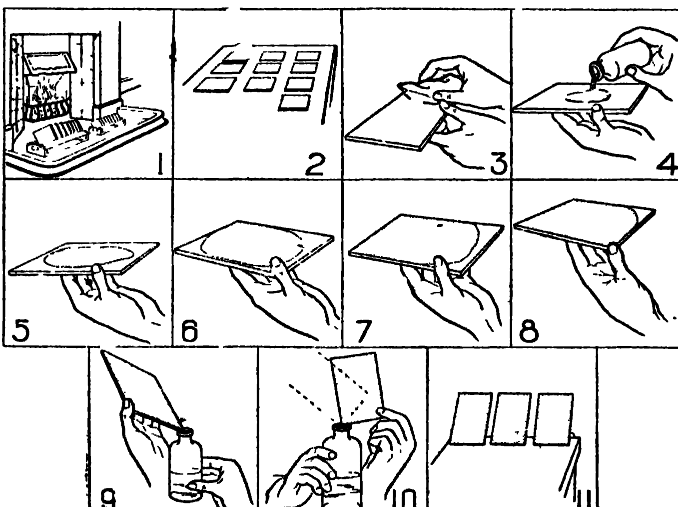
Shellac	3 ozs.	100 gms.
Sodium carbonate (saturated solution)	24 ozs.	800 c.c.s.

The shellac is allowed to soak in the liquid for twenty-four hours; the liquor is then poured away and replaced by an equal quantity of water, and the mixture boiled until the shellac dissolves After standing some time the liquid becomes perfectly clear and bright.

How to Varnish Negatives.

Using Cold Varnish.

First place negatives where they will become perfectly dry, *e.g.*, near a fire (Fig. 1) or on a bath hot-water tank. Next lay out to get quite cold (Fig 2). Remove dust with a strip of cotton plush or camel's



hair brush (Fig. 3) Poise negative on the tips of fingers, steady with thumb, and pour pool of "cold" varnish (bought, or made from one of the formulæ given above), in centre (Fig. 4), using plenty. Let pool spread of itself (Fig. 5). Now incline plate to cause varnish to flow into right-hand far corner (Fig, 6); thence into left-hand far corner

(Fig. 7); thence into left-hand near corner (Fig. 8), and then raise negative so as to flow excess of varnish back into bottle (Fig. 9). (N.B.—In tilting negative to distribute varnish, return plate to level position *a little before* varnish has reached the corner; the wave of varnish will carry the coating into corners, and you will avoid getting varnish on the glass side or up your sleeve.) As last drops run into bottle, rock negative to and fro (Fig. 10), so as to avoid a streaky coating, and as each negative is thus finished stand it on blotting-paper to dry (Fig. 11).

Film Varnishes.

The above water varnish is suitable, or the following:—

Borax	300 grs	30 gms.
Glycerine	300 minims	30 c.c.s.
Shellac	600 grs.	60 gms.
Water	20 ozs.	1,000 c.c.s.

Boil together for about half an hour, then add—

Methylated spirit	5 ozs.	250 c.c s.

and filter.

Another good varnish for celluloid films is—

Dammar	500 grs.	115 gms.
Benzole	10 ozs.	1,000 c.c.s.

in which, after filtration, the films are mmersed and then hung up to dry.

Retouching Medium.

Pale gum resin	200 grs.	230 gms.
Gum dammar	90 grs.	100 gms.
Gum mastic	20 grs.	23 gms.
Oil of juniper	1 gr.	1 gm.
Oil of turpentine	2–4 ozs.	1,000–2,000c.c.s.

The gums are powdered and added to the oils and finally enough pure asphaltum is added to give the mixture a dark amber colour when viewed through the depth of an inch

This formula is strongly recommended by Whiting in his "Retouching" as not liable to pick, rub off, or come off on after-varnishing. It takes a great deal of work.

Ground-Glass Varnish.

Sandarac	90 grs.	103 gms.
Mastic	20 grs.	23 gms.
Ether (0·720)	2 ozs.	1,000 c.c.s.

Dissolve the resins in the ether and afterwards add—

Benzole	¼ to 1½ ozs.	120–700 c.c.s.

The proportion of the benzole added determines the nature of the matt obtained.

This varnish must be applied to the cold negative or the coating will not be matt.

Malachite green, aurantia, or asphaltum is used for tinting it green, yellow, or brown respectively (for handwork on back of negative).

Spotting Medium.

Indian ink	water colour chalk.
Payne's grey	water colour chalk.

Grind together with water only on a palette to match the colour of the negative.

Blocking-Out Mixtures.

No. 1.—Gamboge and vermilion red, or Payne's grey and vermilion, are ground together in water in equal parts with addition of a little gum water if a glossy surface is required.

No. 2.—Asphaltum	1 oz.	100 gms.
Wax	170 grs.	40 gms.
Carbon black	80 grs.	20 gms.
Turpentine	10 ozs.	1,000 c.c.s.

Commercial "Brunswick black" is equal to and more convenient than the above mixture.

When printing on development papers, yellow or orange dye (Vanguard yellow or Griffin's auramine) is a convenient blocking-out medium which is easier in use owing to its transparency. First go over the film with ox gall on wet cotton-wool: the dye then diffuses slightly beyond the edge of the brush work and avoids harsh lines. In subjects containing detail such as ladies' hair, or drapery, a weak dye application over the outline will add the necessary density to the background without clogging the hair. Then proceed as usual, with a stronger wash when stray bits not wanted to print can be taken off without leaving a sharp edge.

Titles on Negatives.

The usual method is to have the words forming the title set up in type and photographed on a "process" plate. The subject negative having been made with a clear margin round it, a strip of the title negative is laid down on this margin by stripping and the clear margin then filled up with "photopake" or other blocking-out mixture except over the strip of title, which is made dense enough, in the first instance, to print white. If a clear portion in a landscape negative cannot be found (in cases where the title has to appear on the view), a piece must be cut out with a sharp knife.

STRIPPING.

Gelatine Glass Negatives.

(Middleton and Holcroft.)

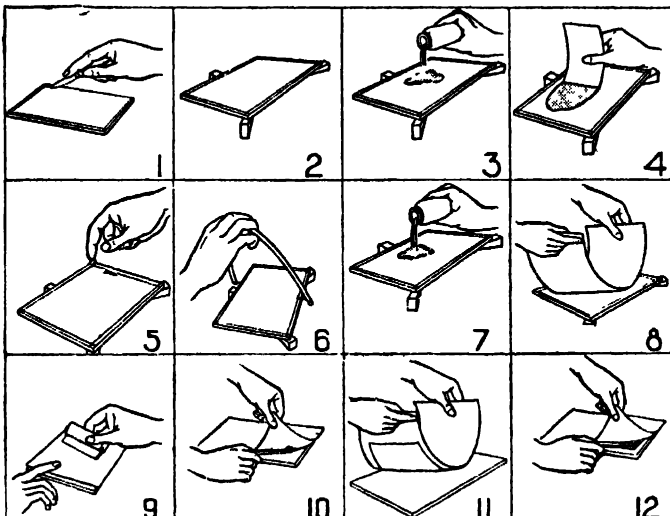
The following is the formula and process for stripping the film from a glass negative and transferring it (with or without reversal) to a second glass-plate or other support:

Stock solution:—

Methylated spirit	25 ozs.	250 c.c.s.
Water	1 oz.	10 c.c.s.
Glycerine	1 oz.	10 c c.s.

To prepare the "stripping solution" 6 to 30 drops of commercial hydrofluoric acid are added to 1 oz. (30 c.c.s.) of the above.

Cut through to the glass all round negative, about $\frac{1}{8}$ inch from edge, with sharp penknife (Fig. 1). Place level on three wooden wedges (Fig. 2). Pour on "stripping solution" (prepared as above) (Fig. 3) Spread solution with an end of paper (Fig. 4). After a minute or so try (with the finger) if the edgings of film are loose, and remove them as soon as they come away without any pull whatever (Fig. 5). Now test if whole film is loose by passing a waxed silk thread stretched on a bow of cane underneath (Fig. 6). If all is free, pour on some plain "stock solution" (Fig. 7), and apply a sheet of waxed paper (Fig 8). The waxed paper is prepared by soaking thin paper in hot melted paraffin for about half an hour. It is semi-transparent and free from buckle. Lightly squeegee down (Fig. 9), and then remove the two together in contact by slipping



the blade of a penknife under the film (Fig. 10). Finally, apply the paper (Fig. 11), with the negative film on the under side, to a glass plate coated with very weak gum solution, dried and flowed over with "stock solution." Then squeegee down (Fig. 9), and remove the waxed sheet, using the blade of the penknife to keep the corner of the film to the glass (Fig. 12).

A less rapid solution, but one which will be safe in the case of an old or hardened negative, is:—

Methylated spirit..	1 oz.	80 c.c s.
Water	2 ozs.	160 c.c.s.
Hydrofluoric acid	60 minims	10 c.c.s.

These proportions may be slightly altered for different commercial spirits and acids

Film Negatives.

In the case of negatives on celluloid cut or roll-film the following is a suitable method:—

Caustic soda	10 grs.	23 gms.
Formaline	10 minims	20 c.c.s.
Water	1 oz.	1,000 c c.s.

The celluloid negative is immersed in this solution until the film shows signs of detachment and can be rolled back with the finger. It is then placed in

Hydrochloric acid	25 minims	50 c.c s.
Glycerine	25 minims	50 c c.s.
Water	1 oz.	1,000 c.c.s.

in which it is removed from its original support to a glass or other base.

For stripping collodion negatives, see end of next section, "Wet Collodion and Collodion Emulsion."

WET COLLODION AND COLLODION EMULSION.

Wet Collodion.

PYROXYLINE (HARDWICH).

Sulphuric acid, 1·845	18 ozs. (fl.)	600 c.c.s
Nitric acid, 1·457	6 ozs. (fl.)	200 c.c.s.
Water	5–5½ ozs (fl)	167–182 c c.s.
Cotton-wool	300 grs.	23 gms.

Temperature 150 degrees F. (65 degrees C.) Time of immersion ten minutes.

IODISED COLLODION.

For Acid Pyro Developer.

Ether, specific gravity 0·725 ..	10 ozs. (fl.)	1,000 c.c.s.
Alcohol, specific gravity 0 805 ..	4 ozs. (fl.)	400 c.c.s.
Pyroxyline	120 grs.	27 gms.
Ammonium iodide	30 grs.	7 gms.
Cadmium iodide	45 grs.	10 gms.
Alcohol (0·830)	4 ozs. (fl.)	400 c.c.s.

BROMO-IODISED COLLODION,

For Iron Developer.

Ether, specific gravity 0·725 ..	10 ozs. (fl.)	1,000 c.c.s.
Alcohol, specific gravity 0 805 ..	5 ozs. (fl.)	500 c.c.s.
Pyroxyline	120 grs	27 gms.
Ammonium iodide	40 grs.	9 gms.
Cadmium iodide	40 grs.	9 gms.
Cadmium bromide	20 grs.	4·5 gms.
Alcohol (0 830)	5 ozs. (fl.)	500 c.c s.

Thinning Collodion after Use.—A mixture of sulphuric ether (0·720), 3 parts, and alcohol (0·805), 2 parts, is generally used.

THE NITRATE BATH.

Silver nitrate	6 ozs.	75 gms.
Distilled water	80 ozs. (fl)	1,000 c.c.s.
Nitric acid (pure)	8 minims	0 2 c.c.s.

Saturate with iodide of silver, which may be done by coating a plate with collodion and leaving it in the bath for some hours. Filter.

DEVELOPER.

No. 1.—	Ferrous sulphate	½ oz.	50 gms.
	Glacial acetic acid	½ oz.	50 c.c.s.
	Alcohol	½ oz.	50 c.c.s.
	Water	10 ozs.	1,000 c.c.s.
No. 2.—	Ferrous ammonio-sulphate ..	75 grs.	43 gms.
	Glacial acetic acid	75 grs.	43 gms.
	Copper sulphate	7 grs.	4 gms.
	Water	4 ozs.	1,000 c c.s.
	Alcohol	¼ oz.	60 c c.s.

INTENSIFIER.

Pyrogallic acid	90 grs.	10 gms.
Citric acid	60 grs.	7 gms.
Acetic acid (glacial)	1 oz.	50 c c s.
Water	20 ozs	1,000 c.c.s.

The copper intensifier (see "Intensifiers") is used for greater density, each solution being flowed over the plate with a rinse between.

Positives and Ferrotypes by Wet Collodion.

BROMO-IODISED COLLODION.

Ether, specific gravity 0·725 ..	10 ozs. (fl.)	1,000 c.c.s.
Alcohol, specific gravity 0·805 ..	5 ozs. (fl.)	500 c.c s.
Pyroxyline	100 grs.	23 gms.
Cadmium iodide	50 grs	11½ gms.
Ammonium bromide	25 grs.	5 7 gms.
Alcohol, 0·830	5 ozs. (fl.)	500 c c.s.

Note.—The iodides should be dissolved in the weaker spirit, and the pyroxyline in the ether and stronger spirit, and the two solutions mixed.

Silver Bath.

Silver nitrate (recryst.)	5½ ozs.	70 gms.
Distilled water	80 ozs. (fl.)	1,000 c.c.s.
Nitric acid (pure)	½ dr.	0·8 c c.

Saturate with iodide of silver and filter as above.

Developers.

Ferrous sulphate	150 grs.	34 gms.
Glacial acetic acid	½ oz.	50 c.c.s
Nitric acid	5 minims	1 c.c.
Alcohol	½ oz.	50 c c.s.
Water	10 ozs.	1,000 c.c.s.

Note.—By increasing the proportion of nitric acid and decreasing that of the acetic, the image will be more metallic in appearance.

Nitrate of Iron Developer.

Ferrous sulphate	1½ oz.	75 gms.
Barium nitrate	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.
Alcohol	1 oz.	50 c.c.s.
Nitric acid	40 drops	4 c.c.s.

The insoluble barium sulphate which is formed must be filtered out.

Fixing Solution.

Potassium cyanide	½ oz	25-30 gms.
Water	15-20 ozs.	1,000 c.c.s.

Developer for Collodion Transfers.

Pyrogallic acid	4 grs.	9 gms.
Citric acid	3 grs.	7 gms.
Acetic acid	20 minims	41 c.c.s.
Water	1 oz.	1,000 c.c.s.
Alcohol	20 minims	41 c.c.s.

Wet Collodion for Half-Tone.

For Winter.

A.—Celloidin	190 grs.	21 gms.
Ether (0·720)	12 ozs.	600 c.c.s.
Alcohol (0 805)	8 ozs.	400 c.c.s.

For Summer.

B.—Celloidin	190 grs.	21 gms.
Ether (0 720)	10 ozs	500 c.c.s.
Alcohol (0·805)	10 ozs.	500 c.c.s

Iodizer.

Cadmium iodide	600 grs.	68 gms.
Ammonium iodide	210 grs.	24 gms.
Sodium iodide	210 grs.	24 gms.
Cadmium bromide	210 grs.	24 gms.
Alcohol	20 ozs.	1,000 c.c.s

Use: Iodizer, 1 part; collodion, 15 parts; and set the mixture aside for at least 4 days to ripen. It should then be a bright yellow; if not, add to each ounce 1 minim of a solution of:—Iodine, 16 grs.; alcohol, 1 oz.

Collodion Emulsion.

PYROXYLINE FOR COLLODIO-BROMIDE OR UNWASHED EMULSION.

Nitric acid, specific gravity 1·45	2 ozs. (fl.)	285 c.c.s.
Sulphuric acid, specific gravity 1·845	4 ozs.	570 c.c.s.
Water	1 oz. (fl.)	145 c.c.s.
Cotton (cleaned and carded) ..	100 grs.	33 gms.

Temperature, 150 degrees F. (65 degrees C.). Time of immersion 10 minutes.

FOR WASHED EMULSION.

Nitric acid, specific gravity 1·45	2 ozs. (fl.)	400 c.c.s
Sulphuric acid, specific gravity 1·845	3 ozs.	600 c.c.s.
White blotting-paper	145 grs.	66 gms.

Temperature, 100 degrees F. (38 degrees C.). Time of immersion 30 minutes.

COLLODIO-BROMIDE EMULSION.

Ether, specific gravity 0·720 ..	5 ozs. (fl.)	620 c.c.s.
Alcohol, specific gravity 0·820 ..	3 ozs.	380 c.c.s.
Pyroxyline..	50 grs.	14·3 gms.
Cadmium ammonium bromide..	80 grs.	23 gms.
or		
Zinc bromide	76 grs.	21·5 gms.

Sensitise by adding to each ounce 15 grs. of nitrate of silver dissolved in a few drops of water and 1 drachm of boiling alcohol. This is suitable for slow landscape work or for transparencies.

WASHED EMULSION (for Transparencies).

Ether, specific gravity 0·720 ..	5 ozs. (fl.)	620 c.c.s.
Alcohol specific gravity 0 820 ..	3 ozs.	380 c.c.s.
Pyroxyline or papyroxyline ..	60 grs.	17 gms.
Cadmium ammonium bromide ..	100 grs.	29 gms.
or		
Zinc bromide	96 grs.	27·5 gms
Hydrochloric acid (specific gravity 1·2)	8 minims	2 c.c.s.

Sensitise with 20 grs. of silver nitrate to each ounce (4·3 gms. to each 100 c.c.s.), dissolved in a minimum of water with 2 drachms (13 c.c.s.) of boiling alcohol Allow to stand for two or three days.

N.B.—In the last formula the emulsion, after being allowed to ripen for the time stated, should be poured into a dish and allowed to become thoroughly dry. The mass of dry emulsion is then washed to remove all the soluble salts, and is then again dried and redissolved in equal parts of ether and alcohol, at the rate of from 20 to 24 grs. to the ounce of solvents.

WELLINGTON'S COLLODIO-BROMIDE EMULSION FORMULA.

Pyroxyline	30 grs.	23 gms.
Ether	12 drs.	500 c.c.s.
Alcohol	12 drs.	500 c.c.s.

To bromise, add 30 grs. (33 gms.) bromide ammonium dissolved in 45 minims (31 c.c.s.) water, to which 4 drachms (170 c.c.s.) of alcohol are afterwards added; 50 grs. (33 gms.) of nitrate of silver dissolved in a drachm (4½ c.c.s.) of water are then added. After washing and drying, the pellicle is dissolved in 1¾ oz. (58 c.c.s.) of ether, and the same of alcohol.

DEVELOPER FOR COLLODION EMULSION.

An excellent developer for collodion emulsion is the following, worked out by the Bolt Court School of Photo-Engraving, London:—

Glycin	190 grs.	17 gms.
Sodium sulphite	1 oz.	40 gms.
Potass. carbonate	2 ozs.	80 gms.
Water to	25 ozs.	1,000 c.c.s.

INTENSIFYING SOLUTION FOR COLLODION EMULSION.

Silver nitrate	60 grs.	70 gms.
Citric acid	30 grs.	35 gms.
Nitric acid	30 minims	35 c.c.s.
Water	2 ozs.	1,000 c.c.s.

To each drachm of a three-grain solution of pyrogallic acid add 2 or 3 minims of the above, and apply until sufficient density is attained.

HÜBL'S CHLOR-BROMIDE COLLODION EMULSION.

Special for Colour Work.

A.—Silver nitrate	480 grs.	50 gms.
Hot distilled water	1 oz.	50 c.c.s.
Dissolve and add		
Alcohol	2 ozs.	100 c.c.s.
Nitric acid	6 drops	10 drops
Shake well, and add to		
4 per cent. collodion	10 ozs.	500 c.c.s.

Shake till any precipitated pyroxyline is redissolved, and then add in small quantities

Zinc bromide (pure anhydrous)	307 grs.	32 gms.
Absolute alcohol	2¾ ozs.	128 c.c.s.

shaking between each addition; then add

Nitric acid	24 minims	1·5 c.c.
Hydrochloric acid	24 minims	1·5 c.c.

This should be gently warmed before adding to the collodion. Allow to stand for twenty-four to thirty-six hours, or till the emulsion appears a greyish-violet by transmitted light, then add

Zinc chloride (pure anhydrous) .. 77 grs. 3.2 gms.

or sufficient to convert the whole of the uncombined silver nitrate into chloride, which can be tested for with potassium chromate. It is advisable to dissolve the zinc chloride in about four times its volume of acid. The emulsion should then be precipitated by pouring

into plenty of water, the threads collected and shaken up with alcohol and drained, and then dissolved in

Absolute alcohol	10 ozs.	500 c.c.s.
Ether, washed	10 ozs.	500 c.c.s.

Stripping Wet Collodion Negatives.

When the negative is thoroughly dry and cool, flow over with thin solution of rubber in benzole, 2 parts pure rubber to 100 parts benzole, or ordinary cycle tyre repairing solution thinned down to about the consistency of collodion will do. When this is dry, the negative is flowed over with "leather" collodion. This is prepared by adding a small quantity of castor oil to plain collodion. A good formula is as follows:—

Celloidin	½ oz.	2 gms.
Ether	5 ozs.	50 c.c.s.
Alcohol	5 ozs.	50 c c.s.
Castor oil	½ oz.	2 c.c.s

When the collodion on the negative is dry (and the drying can be hastened by heat) the negative is cut round the edges with a knife and placed in a dish of cold water. The film should soon begin to loosen at the edges; if it does not a little acetic acid (up to 10 per cent.) may be added to the water. The film is now transferred to a piece of paper, and thence to the new support. If the negative is to be reversed it is transferred to another piece of paper before being placed on its final support.

PLAIN AND ALBUMEN PAPERS.

Plain Paper.

The following are formulæ for "salting" and sensitizing papers such as Whatman's drawing papers, pure Rives paper, etc.

First prepare the plain paper with—

Ammonium chloride	60–80 grs.	14-18 gms.
Sodium citrate	100 grs.	23 gms.
Sodium chloride	20–30 grs.	4·5–7 gms.
Gelatine	10 grs.	2 gms.
Distilled water	10 ozs.	1,000 c.c s.

or—

Ammonium chloride	100 grs.	23 gms.
Gelatine	10 grs.	2 gms.
Water	10 ozs.	1,000 c.c.s.

The gelatine is first swelled in cold water and then dissolved in hot water, and the remaining components of the formula are added. The solution is filtered, and, when still warm, the paper floated upon it for three minutes and dried.

The salted paper is sensitized upon a neutral 45-grain silver bath.

PLATINUM TONING BATH.

Potass. chloroplatinite	4½ grs.	1 gm.
Water	10 ozs.	1,000 c.c.s.
Nitric acid	2–3 drops.	5–10 drops.

Albumen Paper.

The albumenized paper, as purchased, is sensitized on the following silver solution :—

Silver nitrate	600 grs.	140 gms.
Distilled water	10 ozs.	1,000 c.c.s.

The bath is made just acid with nitric acid, requiring three or four drops per 10 ozs

TONING BATHS.

No. 1.—Gold chloride	1 gr.	0·3 gm.
Sodium acetate	30 grs.	6 gms.
Water	8 ozs.	1,000 c.c.s.

This must not be used till one day after preparation. It keeps well and gives warm, rich tones.

No. 2.—Gold chloride	15 grs.	1 gm.
Water	4 ozs.	120 c.c.s.

Add lime water until a piece of red litmus paper, placed in the solution, is turned blue. Then add—

Calcium chloride, fused	120 grs.	7·7 gms.
Water to make	7½ ozs.	115 c.c.s.

This solution is diluted with 15 times its volume of water to make the toning bath; it can be used over and over again by addition of stock solution.

PRESERVATIVE FOR SENSITIZED ALBUMEN PAPER.

Sensitize the paper in the usual bath, drain well, and when superficially dry float the back of the paper for twenty minutes on a solution of—

Citric acid	1 oz.	33 gms
Water	30 ozs.	1,000 c.c.s.

TO PREVENT BLISTERS IN ALBUMEN PRINTS.

Before wetting the prints immerse them in methylated spirit, then wash and tone as usual

GELATINE P.O.P.

Emulsion Formulæ.

BARKER'S.

Gelatine (Nelson's No. 1 and Coignet's, equal parts)	175 grs.	80 gms.
Ammonium chloride	18 grs.	8 gms.
Rochelle salts	50 grs.	23 gms.
Silver nitrate	75 grs.	34 gms.
Alcohol	4 drs.	160 c.c.s.
Water	5 ozs.	1,000 c.c.s.

Heat to 100 degrees F. (38 degrees C.), and allow to remain at this temperature after all is dissolved for ten minutes, after which proceed in the usual way.

VALENTA'S.

A.—Silver nitrate	.. .. ..	480 grs.	32 gms.
Citric acid ..	.. .. ..	120 grs.	8 gms.
Hot water ..	.. .. ..	5½ ozs.	160 c.c.s.
B.—Gelatine ..	.. .. ..	1,440 grs.	96 gms.
Ammonium chloride	.. ..	42 grs.	2·8 gms.
Water ..	.. .. ..	24·3 ozs.	700 gms.
C.—Tartaric acid	.. .. ..	42 grs.	2·8 gms.
Sodium bicarbonate	.. ..	21 grs.	1·4 gm.
Alum ..	.. .. ..	27 grs.	1·8 gm.
Water ..	.. .. ..	5 ozs.	140 c.c.s.

Allow the gelatine to swell in the water and melt by the aid of heat, and add the chloride. Mix B and C at 50 degrees C., and in yellow light add A, heated to the same temperature, in small quantities, shaking thoroughly, and allow the emulsion to ripen for a short time at from 40 degrees to 50 degrees C. and then filter For matt surface papers the gelatine should be reduced to 750 grs. or 80 gms.

The above formula gives vigorous brilliant prints, but for soft negatives a harder printing emulsion is obtained by adding from 0 05 to 0·1 per cent. of calcium bichromate solution; this can be made by dissolving 480 grs. or 25 gms. of pure chromic acid in 4 ozs. or 100 c.c.s. of distilled water, and adding sufficient pure chalk (calcium carbonate) to make the solution cloudy. The solution should then be filtered, and the filter washed with distilled water up to 4 ozs. or 100 c.c.s.

BEADLE'S.

Nelson's gelatine ..	.. ..	340 grs.	112 gms.
Alum ..	.. .. ..	15 5 grs.	5 gms.
Water ..	.. .. ..	6¼ ozs.	900 c.c.s.
Rochelle salts ..	.. ..	15 5 grs.	3·5 gms.
Ammonium chloride	.. ..	11 grs.	5 gms
Heat to 50 degrees C., and add—			
Silver nitrate	.. .. ..	115 grs	37·5 gms.
Citric acid ..	.. .. ..	62 grs.	20 gms.
Water ..	.. .. ..	1 oz.	100 c.c.s.

Procedure in P.O.P. Printing.

Wash prints in several changes of water until wash water ceases to show milkiness when poured into clean glass measure (time, 10 to 15 minutes). Tone in gold bath (5 to 10 minutes). Again wash as thoroughly as before toning. Fix in:—hypo, 2 to 3 ozs.; water, 20 ozs., for 10 minutes. Finally wash in running water or frequent changes (every 5 or 10 minutes) for 1 to 2 hours.

Prints can be toned in a platinum bath instead of in one of gold (see formulæ below). The other manipulations remain the same as above. The tones are best suited to matt surface paper.

Prints can be toned and fixed at the same time in a "combined" bath (see formulæ below). With some baths and papers it is best to wash before toning; with others it is not necessary. The tones by the "combined" method are almost always warmer than by separate toning and fixing Also they are somewhat inferior in permanence.

P.O P. prints may be printed faintly and then developed up to full strength (see "Developing P.O.P" below). The colour of the developed prints is usually not pleasing, and it is necessary to tone. This is done as a rule in a combined bath. P O.P. to be developed must not be exposed to strong light before printing, when loading frames or examining prints It must be handled as though it were "gaslight" paper.

Gold Toning Baths.

SULPHOCYANIDE.

This is the best and most generally used toning bath for P.O.P. and yields fine purplish tones.

Gold chloride	$2\frac{1}{2}$ grs.	0 3 gm.
Ammonium sulphocyanide ..	30 grs.	3 5 gms.
Water	20 ozs.	1,000 c.c.s.

It is necessary for this and all sulphocyanide baths to ripen. The best method of mixing is to boil the water and to dissolve the gold in one half and the sulphocyanide in the other—both scalding hot. Then pour the gold into the sulphocyanide in small doses, stirring all the time: use when cool. If cold water is used, the mixture should be allowed to stand 12 hours.

CONCENTRATED SULPHOCYANIDE.

(Buhler's Formula.)

A.—Distilled water	1 oz.	150 c.c.s.
Gold chloride	15 grs.	5 gms.
B.—Strontium chloride	150 grs.	50 gms.
Distilled water	$\frac{3}{4}$ oz.	100 c.c.s.
C.—Potassium sulphocyanide ..	80–150 grs.	25–50 gms
Distilled water	$1\frac{3}{4}$ oz.	250 c.c.s.

Heat B to boiling, and add A (heated to 150 degrees F.) in small doses. Bring C to boiling, and allow to cool to 205 degrees F., and add the hot mixture of A and B in four or five lots with constant stirring; cool and filter. If a precipitate forms, reheat to nearly boiling, wash the filter with $\frac{3}{4}$ oz. (100 c.c.s.) water, and add this latter to the total bulk. The bath is diluted with 10 times its volume of water for use.

FORMATE.

Gold chloride	1 gr.	0 12 gm.
Sodium bicarbonate	2 grs.	0·23 gm.
Sodium formate	8 grs	0 9 gm.
Water	20 ozs.	1,000 c.c.s.

The prints should be immersed in a 10 % solution of salt and water before using this bath.

TUNGSTATE.

Sodium tungstate..	30 grs.	3·5 gms.
Sodium carbonate..	1 gr.	0·12 gm.
Gold chloride ..	1 gr.	0·12 gm.
Water	10-20 ozs.	500-1,000 c.c.s

An excellent bath for warm brown tones.

THIOCARBAMIDE.

Gold chloride	4 grs.	0 25 gm.
Distilled water	1 oz.	25 c.c.s.

Add, to dissolve precipitate first formed, sufficient of—

Thiocarbamide	90 grs.	1 gm.
Distilled water	10 ozs.	50 c.c.s.

About ½ oz. (14 to 15 c c.s.) will be needed. Next add—

Citric acid	8 grs.	0·5 gm.

and

Distilled water to	35 ozs.	1,000 c.c.s.

and finally

Salt	160 grs.	10 gms.

The prints should be thoroughly washed *before* as well as after fixing.

SHORT STOP FOR GOLD TONING.

A weak solution of sodium sulphite (5 grs. per oz) at once arrests the action of a gold toning bath.

SALT BATH

A short immersion of prints in the following bath prior to the first washing favours even toning and prevents spots and stains from rusty tap water :—

Salt	2 ozs.	100 gms.
Sodium carbonate	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.

If prints are to be toned in the platinum bath the carbonate should be omitted.

Platinum Toning Baths.

PHOSPHORIC ACID.

Potass. chloroplatinite	4 grs.	0·45 gm.
Phosphoric acid (sp. gr. 1·12) ..	¾ oz. (fl.)	35 c.c.s.
Water to	20 ozs.	1,000 c.c s.

CITRIC ACID

Potass. chloroplatinite	4 grs.	0 45 gm.
Sodium chloride (salt)	40 grs.	4·5 gms.
Citric acid	50 grs.	5 8 gms.
Water to	20 ozs.	1,000 c.c.s.

HADDON'S FORMULA.

Platinum perchloride	3 grs.	0·2 gm.
Sodium formate	100 grs.	6·5 gms.
Formic acid	30 minims	1·8 c.c.
Water to	35 ozs.	1,000 c.c.s.

Short Stop for Platinum Toning.

A weak solution of sodium carbonate (10 grs. per oz.) instantly arrests the toning action of a platinum bath.

For Black Tones.

Tone in— (*Valenta.*)

Potass. chloroplatinite	2½ to 10 grs.	0·5 to 2 gm.
Metaphenylene-diamine	2½ to 10 grs.	0·5 to 2 gm.
Water	10 ozs.	1,000 c.c.s.

having first washed the prints well.

Another method is to print deeply and immerse the prints in—

Salt	1 oz.	25 gms.
Sodium bicarbonate	80 grs.	9 gms.
Water	20 ozs	1,000 c.c s.

then wash well and tone in a borax gold bath to a purple red. Again well wash and tone in the phosphoric platinum bath.

For Red.

(*Valenta.*)

Uranium nitrate	10–20 grs.	1–2 gms
Thiosinamine	90 grs.	10 gms.
Water	20 ozs	1,000 c.c.s.

The prints are well washed, finally in water acidulated with acetic acid, and then toned. They are afterwards fixed, or can be toned to sepia brown in the combined bath.

Gold-Platinum (One Solution).

Citric acid	90 grs	10 gms
Salt..	90 grs.	10 gms.
Potass. chloroplatinite	4-8 grs.	½-1 gm.
Gold chloride	4-8 grs.	½-1 gm.
Water	20 ozs.	1,000 c.c.s.

Twice the amount of water may be used if the bath acts too quickly. If the proportion of gold to platinum is increased the tone is warmer. The prints must be well washed before fixing.

Combined Baths.

Valenta's.

Hypo	8 ozs.	400 gms.
Ammonium sulphocyanide ..	1 oz.	50 gms.
Lead nitrate	175 grs.	20 gms.
Alum	350 grs.	40 gms.
Water to	20 ozs.	1,000 c.c.s.

Dissolve the hypo in the water, add the sulphocyanide, then add the alum dissolved in a little water, and also the lead, and add to the hypo. Heat the mixture to 120 deg. F. for ten minutes; allow to cool. For use take—

Stock solution (as above) ..	10 ozs.	100 c c.s.
Water	10 ozs.	100 c.c.s.
Gold chloride (from stock sol.) ..	3½ grs.	0·23 gm.

ALKALINE TONING AND FIXING BATH.

Gold chloride	2 grs.	0·23 gm.
Lead nitrate	10 grs.	1 2 gm.
Chalk	½ oz.	25 gms.
Hypo	4 ozs.	200 gms.
Water	20 ozs.	1,000 c.c.s.

Shake the solution well, allow to settle, and use the clear portion. If prints tone too quickly, under 10 minutes, in the combined bath, it is best to pass them afterwards through a plain fixing bath.

Reducer for Over-Printed Proofs.

A.—Ammonium sulphocyanide	10% sol.
B.—Potass. ferricyanide	10% sol.

A, 5 ozs. ; B, ½ oz ; water, 24 ozs.

This is used on the prints after toning, fixing and well washing out the hypo in the usual way.

Developing P.O.P.

DIRECT PROCESS WITH ACID DEVELOPER.

Hydroquinone	16 grs.	18·5 gms.
Citric acid	40 grs.	4·6 gms.
Sodium acetate	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c s.

Immerse the dry prints in the developer, and, after development, wash in plenty of water for ten or fifteen minutes, then tone in the usual way.

Pyro (Blacklock).

A.—Pyro	40 grs.	4·6 gms.
Tartaric acid	40 grs.	4·6 gms.
Water	20 ozs.	1,000 c.c.s.

Will keep three or four weeks.

B.—Potass. bichromate	1/16 gr.	0·009 gm.
Water	16 ozs.	1,000 c.c.s.

B is best made up from a stock solution of 1 gr. per ounce, adding ½ dr. of it to 16 ozs. of water. To develop, mix equal parts of A and B.

Six or seven inches of magnesium ribbon burnt close to the frame, will suffice for the exposure.

The fixing bath is :—

Hypo	3½ ozs.	160 gms.
Lead acetate	200 grs.	23 gms.
Water	20 ozs.	1,000 c.c.s.

in which the prints lose very little.

PAGET "BROMIDE" PROCESS.

The prints are immersed in 10 per cent. potass bromide solution for five or ten minutes, washed and developed with the following :—

A.—Hydroquinone	40 grs.	4·5 gms.
Sodium sulphite	160 grs.	18 gms.
Water to	20 ozs.	1,000 c.c.s.

B.—Potass. bromide	.. .. ..	$2\frac{1}{2}$ ozs.	125 gms.
Sodium carbonate	.. ..	2 ozs.	100 gms.
Water to	.. ..	20 ozs.	1,000 c.c.s.
C.—Potass. cyanide	.. .. ..	$\frac{1}{2}$ oz.	25 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

For average negatives, mix:—A, $\frac{1}{2}$ oz.; B, 1 oz.; C, 20 minims; water, $\frac{1}{2}$ oz.

For flat negatives (greater contrast), A, 3 drs.; B, 1 oz; water, 5 drs.

For hard negatives (soft results), A, 7 drs.; B, 1 oz; water, 1 dr.

The cyanide solution is used as above in quantity sufficient to keep the backs of prints clean.

Glazing P.O.P.

POLISH FOR SQUEEGEEING GLASSES

A polishing medium to be applied to glass or ferrotype before squeegeeing the print is—

Beeswax	.. ..	20 grs	45 gms.
Turpentine	.. ..	1 oz.	1,000 c.c.s.
or			
Spermaceti wax	.. .. ..	20 grs.	45 gms.
Benzole	.. ..	1 oz.	1,000 c c.s.

a few drops of which are rubbed on with a piece of flannel, and the glass afterwards polished with silk rag or chamois leather.

ENAMEL COLLODION.

Soluble gun cotton	.. ..	50 grs.	14 gms.
Alcohol	.. ..	4 ozs.	500 c.c.s.
Sulphuric ether	.. .. ..	4 ozs.	500 c.c.s.

Glass plates cleaned with French chalk are coated with the above, and, as soon as coating has set, slipped under prints which are waiting face down in water. Prints are withdrawn and squeegeed. When half dry they are given a backing paper and finally stripped off. (For both gelatine and collodion prints.)

COLLODIO-CHLORIDE P.O.P.

Emulsion Formula.

(*Valenta*.)

1.—Strontium chloride	.. ..	154 grs.	10 gms.
Lithium chloride	..	77 grs.	5 gms.
Water	.. .. ..	500 minims	30 c.c.s.
Alcohol (absolute)	..	930 minims	55 c.c.s.
2.—Silver nitrate	.. ..	400 grs.	20 gms.
Water	.. .. ..	500 minims	30 c.c.s.
Alcohol	.. .. ..	1,000 minims	60 c.c.s.
3.—Citric acid	.. .. ..	77 grs.	5 gms.
Alcohol	.. .. ..	675 minims	40 c.c.s.
Glycerine	.. .. ..	92 grs.	6 gms.

In a bottle capable of holding 1,000 parts pour 350 parts of 3 per cent. collodion and add gradually 15 parts of No. 1. Then in the dark room add almost drop by drop 60 parts of No. 2, shaking well after each addition; then add 50 parts of No. 3 and 50 parts of ether. This collodion is suitable for normal negatives, but more contrast can be obtained if 0·1 to 0·4 per cent. calcium chromate solution is added. By reducing the amount of pyroxyline in the above formula the emulsion is more suitable for matt surface paper. (See "Gelatine P.O.P")

Procedure in C.C. Printing.

Prints are washed in changes of water until latter is free from milkiness, and then toned either with gold or platinum, but most usually and for the best warm black tones, first in gold and then (after washing in platinum. They are then again well-washed and fixed like gelatine P.O P. prints. C.C. prints as a rule do not yield the best results in the combined bath. C.C papers are not suitable for the "development" process described under Gelatine P.O.P.

Gold-Platinum Toning.

For Black Tones.

The following is the usual practice in toning collodion prints :—

Wash in several changes, and tone the shadows to a brown (wh seen by transmitted light) in the following :—

Borax	90 grs.	10 gms.
Gold chloride	2 grs.	0·2 gm.
Water	20 ozs.	1.000 c.c.s.

This bath is ready within a few minutes of mixing. It is conveniently made just before washing the prints. The quantity of borax is adjusted to the working. If the lighter tones disappear, add more borax; if the prints lack brilliance, add gold. After a ten-minute wash, transfer to the platinum bath, which may be strong or weak, the only difference being that a larger number of prints may be treated together in the weaker bath.

Stock solution :—

Potass. chloroplatinite	30 grs.	7 gms.
Phosphoric acid (specific gravity 1·12)	5 drs.	30 c.c.s.
Water to make	20 ozs.	1,000 c.c.s.

This may be made up to 60 ozs. at once, or added little by little o water, as the prints are passed through a few at a time.

The prints are next washed in about eight changes of water (to the fifth or so of which it is well to add a little bicarbonate of soda to neutralise traces of acid) before fixing.

Gold Toning Baths.

BORAX-ACETATE.

Borax	90 grs.	10 gms.
Sodium acetate	90 grs.	10 gms.
Gold chloride	2½ grs.	0·3 gm.
Water	20 ozs.	1,000 c.c.s.

SULPHOCYANIDE.

Ammonium sulphocyanide ..	90 grs.	10 gms.
Gold chloride	2½ grs.	0·3 gm.
Water	20 ozs.	1,000 c.c.s.

For bluish-black tones.

SULPHOCYANIDE-ACETATE.

Ammonium sulphocyanide ..	35 grs.	4 gms.
Sodium acetate	¾ oz.	45 gms.
Gold chloride	5 grs.	0·6 gm.
Water	20 ozs.	1,000 c.c.s.

Is made up one hour before using, preferably from stock solutions of the substances. With sodium tungstate, instead of the acetate, gives fine chestnut tones.

The maker's formulæ should be studied in connection with the above baths as papers differ considerably in the quantity of gold required in the toning solution.

Platinum Toning Baths.

The phosphate formula given above under "Gold Platinum Toning" is suitable for the production of the warm brown and sepia tones, which are given by the platinum baths alone. Others are:—

Citric acid	45 grs.	5 gms.
Potass. chloroplatinite	4 grs.	0·5 gm.
Water	20 ozs.	1,000 c.c.s.

Lactic acid (specific gravity 1 21)	25 grs.	3 gms.
Potass. chloroplatinite	4 grs.	0·5 gm.
Water	20 ozs.	1,000 c.c.s.

SALT-BICARBONATE BATH.

The following is used between washing and toning with the platinum bath as a means of removing free silver, and bringing the prints into a state of regular neutrality:—

Salt	½ oz.	25 gms.
Sodium bicarbonate	45 grs.	5 gms.
Water	20 ozs.	1,000 c.c.s.

Toning Baths for Various Warm Tones.

For Warm Sepia Tones.

The prints are washed in three changes of warm water and placed in:—

Ammonia	1 dr.	6 c.c.s.
Warm water	20 ozs.	1,000 c.c.s.

until they become lemon yellow. They are then again washed in three changes of water and toned for about one minute in the gold borax bath above.

For Red Chalk Tones.

The prints are washed in a couple of changes of water and placed for about half an hour (until they become orange-yellow) in :—

Salt..	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.

After which they are washed for about one minute and toned, for a few seconds only, in the borax bath above.

For Violet Tones.

Print deeply from the negatives and tone until the colour desired is reached in :—

Hydrochloric acid	6 ozs.	300 c.c.s.
Gold chloride	10 grs.	1·2 gm.
Water to make	20 ozs.	1,000 c.c.s.

After which wash thoroughly and fix in 5 per cent. hypo. Less acid in the above bath tends to bluish-violet, more to violet purple.

Combined Baths.

Collodion papers, although not generally suitable for use with the combined bath, may in some cases be toned in it. The Valenta formula (see "Gelatine P.O.P." above) is suitable, also the following (Kurz) :—

Water	20 ozs.	1,000 c.c.s.
Hypo	5 ozs.	250 gms.
Ammonium sulphocyanide	240 grs.	28 gms.
Alum	70 grs.	7 5 gms.
Citric acid	70 grs.	7·5 gms.
Lead nitrate	90 grs.	10 gms.
Lead acetate	90 grs.	10 gms.
Gold chloride	3½ grs.	0·4 gm.

is turbid when first made, but clears after a few days.

BROMIDE AND GASLIGHT PAPERS.

Procedure.—Bromide paper must be handled in yellow or orange light: gaslight can be worked in weak day or artificial light. Bromide papers develop in from two to five minutes, whilst many (but not all) gaslight papers develop in a second or two. Apart from these distinctions the general working of the two classes of paper is the same, viz., exposure which has no visible effect on the paper; development; a brief rinse; fixing in :—hypo, 3 to 4 ozs.· water 20 ozs. ;

and thorough washing in running water or frequent changes, say for one hour.

The following developers are a few only of the standard. The makers' formulæ should be consulted.

Amidol.

Sodium sulphite	.. .. ..	650 grs.	74 gms.
Potass. bromide	.. .. ..	10 grs.	1·2 gm.
Water	.. ..	20 ozs.	1,000 c.c.s.
When dissolved add—			
Amidol	.. ..	50 grs.	5·7 gms.

This developer will not keep more than three days.

See also the formula given under "Negative Developers."

The most convenient and economical method of using amidol developer for bromide papers is to make up a 10 per cent. stock solution of sodium sulphite, and add 5 grs potassium bromide to each 10 ozs. solution. For use add 4 grs. dry amidol to each ounce stock solution, and dilute with an equal bulk of water.

Eikonogen-Hydroquinone.

(See under "Developers and Development.")

Metol.

A.—Metol	.. .. ..	100 grs.	11·5 gms.
Sodium sulphite	.. ..	2 ozs.	100 gms.
Potass. bromide	.. ..	12 grs.	1·4 gm.
Water	.. .. ..	20 ozs.	1,000 c.c.s.
B.—Potass. carbonate	.. ..	2 ozs.	100 gms.
Water	.. .. ..	20 ozs.	1,000 c.c.s.

For use take 3 ozs of A and 1 oz. of B.

For gaslight papers use half the quantity of water in above formula.

Metol-Hydroquinone.

Metol	.. ..	8 grs.	1 gm.
Hydroquinone	.. .. ..	30 grs.	3·5 gms.
Sodium sulphite	.. .. ..	¾ oz.	37·5 gms.
Sodium carbonate	.. ..	¾ oz.	37·5 gms.
10% solution of potass. bromide		20 minims	2·5 c.c.s.
Water	.. ..	20 ozs.	1,000 c.c.s.

For gaslight papers make up above formula with 10 ozs. of water.

Rodinal.

Rodinal	.. .. ..	100–150 minims	6–9 c.c.s.
Water	.. ..	10 ozs.	300 c.c.s.
10% solution of potass. bromide		20 minims	1 c.c.

Ortol.

A.—Ortol	.. ..	120 grs.	14 gms.
Potass. metabisulphite	.. ..	60 grs.	7 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.
B.—Sodium sulphite	.. .. ..	4 ozs.	200 gms.
Potass. carbonate	.. .. ..	1 oz.	100 gms.
Potass. bromide	.. .. ..	20 grs.	2·3 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

Use equal parts of A and B.

For gaslight papers use half the quantity of water given in this formula.

Ferrous Oxalate.

A.—Sulphate of iron	.. .. ..	5 ozs.	250 gms.
Sulphuric acid	.. .. ..	30 minims	3 c.c.s.
Warm water to	.. .. ..	20 ozs.	1,000 c.c.s.
B.—Potass. oxalate (neutral)	.. ..	5 ozs.	250 gms.
Potass. bromide	.. .. ..	10 grs.	1·2 gm.
Warm water to	.. .. ..	20 ozs.	1,000 c.c.s.

For use add 1 oz. of A to 4 ozs. of B, not *vice versâ.*

After development and without washing, immerse the prints for two minutes in acid bath, pour off and repeat.

ACID BATH.

Glacial acetic acid	.. ..	1 dr.	6 c.c.s.
Water	.. ..	20 ozs.	1,000 c.c.s.

Then wash thoroughly to remove last trace of acid.

Clearing Bath.

To remove yellow stain from bromide prints, the following is suitable:—

Alum (saturated solution)	..	10 ozs.	1,000 c.c.s.
Hydrochloric acid	.. ..	3 drs.	40 c.c.s.

Reducer for Bromides.

Over-developed prints are best treated in a weak iodine-cyanide reducer made from (A) 10% solution of iodine in potass. iodide and (B) 10% potass. cyanide solution. Take:—

A.	.. ..	30 minims	2 c.c.s.
B.	.. ..	10 minims	0 6 c.c.
Water	.. ..	2 ounces	60 c.c.s.

Adding more of A and B if necessary.

Strong Prints from Flat Negatives.

The prints are fully exposed and over-developed, fixed and washed. They are then placed in the following iodine bath until whites are strongly blue, and then fixed for five minutes.

IODINE BATH.

Potass. iodide	30 grs.	7 gms.
Iodine	3 grs.	0·7 gm.
Water	10 ozs.	1,000 c.c.s.

If not sufficiently lightened, the print may be washed and the process with bleaching bath and hypo repeated.

Stress Marks on Bromides.

Avoid rubbing paper against other sheets in boxes or packets, and against negative or mask In cutting up large sheets, use shears on open sheet, not knife, etc, which rubs on emulsion surface. Have developer water-clear, free from sediment and any floating dirt Use plenty of developer.

Addition of from 40 to 60 minims of 10 per cent. solution of potass cyanide to each 10 ozs. of developer will avoid stress marks in many cases, or a developer may be made up as follows.—

Soda sulphite	1 oz	50 gms.
Water	20 ozs.	1,000 c.c s.
Potass bromide	2 grs	0 23 gm
Amidol	35 grs.	4 0 gms
Potass. cyanide	2 grs	0·23 gm.

If stress marks occur, they can usually be removed by gently rubbing each print with a soft rag as soon as it has had a minute or so in the wash-water. A further aid to removal is a solution of borax, ½ oz ; water, 20 ozs.; methylated spirit, 5 ozs., rubbed over with soft rag or cotton wool.

Hypo-Alum Toning.

The following is a method (much used on the commercial scale) for toning bromide prints to a warm purplish sepia.—

Hot water	20 ozs.	1,000 c.c.s.
Hypo	2½ ozs.	125 gms.

Dissolve and add—

Alum	½ oz.	25 gms.

This mixture should not be filtered, and it works better as it becomes older; it may be strengthened from time to time with a little fresh solution.

The best results are obtained by keeping the bath hot, or as warm as the emulsion will stand, say 100 to 120 degrees F. In this bath prints will tone in 30 to 40 minutes. When this toning bath is to be employed, the use of the alum bath after fixing is absolutely essential. Moreover, the prints should not, in this case, be subjected to a prolonged washing, but should only be slightly rinsed before being dried

A new bath tends to reduce the prints rather more than an old one.

When toned the prints should be placed in a tepid solution of—

Water	70 ozs.	1,000 c.c.s.
Alum	2 ozs.	30 gms.

and then washed thoroughly.

Sulphide Toning.

Of the many methods of producing sepia to warm brown tones on bromide or gaslight the following is the best and most reliable. Prints require to be well washed from hypo before being put into the bleacher. In summer, or in places where the water supply has a softening action on prints, it is well to fix them in a fixing-hardening bath. (See "Fixing.")

BLEACHER.

Ammonium bromide	.. ..	100 grs.	11 gms.
Potass. ferricyanide	.. ..	300 grs.	35 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

SULPHIDE BATH.

It is best to keep the sulphide in strong, 20 per cent., solution; a weak solution does not keep well. Use the pure *white* sulphide, dissolving 4 ozs. in water and making up to 20 ozs

To make the working sulphide bath, mix:—

Stock 20% sulphide solution	.. .. ..	3 ozs.
Water to make	.. ..	20 ozs

The prints are treated for two or three minutes in the bleacher—that is, until the picture becomes faint brown in colour. If any black is left at the end of two minutes it is a sign that the bleacher (which may be used repeatedly) is becoming exhausted.

Rinse in clean water for half-a-minute to one minute. Longer washing at this stage does no good and may lead to impaired tone.

Transfer to sulphide bath, where prints should darken to the full brown or sepia in a second or two.

Throw away the sulphide bath after the day's use. Stale spoilt sulphide solution is the most frequent cause of bad tones or of refusal of prints to darken in the sulphide bath.

Finally wash for half-an-hour in running water.

The results by the sulphide process are quite permanent.

Blue stains in spots and patches, on sulphide-toned prints are due to iron, either as rust in the tap-water, or as impurity in alum. Fit a flannel filter to the tap and use pure alum. Wiping with cotton-wool saturated with strong hydrochloric acid will slowly change the stain to yellow which washes out in water. But it is a rather risky remedy.

Sulphide-toned prints of bad colour or insufficient depth can be re-treated, e.g., by bleaching in;—copper bromide, 130 grs.; sodium bromide, 2½ ozs.; water, 10 ozs. This is used in the dark-room, the bleached print taken into daylight and re-developed with amidol or other clean developer, after which it may be retoned.

Permanganate Bleach Process.

(*T. H. Greenall's formula.*)

This process allows of prints being toned after a very brief rinse from the fixing bath; also it requires no washing (or only the briefest) between bleaching and sulphiding.

BLEACHER.

A.—Hydrochloric acid B.P. 31·8%	..	3 ozs.	150 c.c.s.
Water to make	.. .. ..	20 ozs.	1 000 c.c.s.
B.—Potass. permanganate	.. ..	40 grs	4 5 gms
Water	.. ..	20 ozs.	1,000 c.c.s.

Both A and B keep indefinitely when well stoppered.

To make the bleacher, mix in order given:—Water, 6 ozs.; A, 1 oz.; B, 1 oz. Cost of working mixture is about ¼d. per 20 ozs. If prints do not bleach completely, throw bleacher away and mix fresh. Any brown stain disappears in the sulphide bath, which should be of strength 1 gr. per oz. made up from strong solution.

If, by using more of A or B than directed above, there is any brown stain on sulphided prints, a bath of Oxalic acid, ½ oz.; water, 50 ozs., with a few crystals of soda sulphite dissolved in it, will at once remove them

Copper Toning.

This process yields a range of tones from warm black to red chalk, the warmth of tone increasing as the solution acts on the print. The process does not intensify the prints; it is cheap and the results are permanent

A.—Copper sulphate	.. .. ..	60 grs.	7 gms.
Potass. citrate (neutral)	.. ..	240 grs.	28 gms.
Water	.. ..	20 ozs.	1,000 c.c s.
B.—Potass. ferricyanide	.. ..	50 grs.	6 gms.
Potass. citrate (neutral)	.. ..	240 grs.	28 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

Use equal parts of each. If prints are pinkish in the high-lights, use more citrate in the A or B solution.

Platinum Toning.

Not for Gaslight Prints.

Potass. chloroplatinite	.. ..	12 grs.	0 8 gm.
Mercuric chloride	.. .. ..	6 grs.	0·4 gm.
Citric acid	.. ..	54 grs.	3·4 gms.
Water	.. ..	6 ozs.	170 c c.s.

This bath should be made up fresh for use from stock solutions. Gives warm sepia tones, with slight staining of high-lights. For cold sepia tones and absence of staining add 30 minims 10 per cent. solution potassium bromide to above. Wash well after toning.

Uranium Toning.

This old method yields brown to reddish tones. It intensifies the prints, and the results often prove impermanent.

A.—Uranium nitrate	.. .. ..	90 grs.	10 gms.
Water	.. ..	20 ozs.	1,000 c.c.s
B.—Potass. ferricyanide	.. ..	90 grs.	10 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

Use equal parts of A and B, and add 20 minims of glacial acetic acid to each ounce of mixture. The prints must be free from hypo.

After toning wash in several changes of *still* water till the high-lights are clear. Washing in running water will remove the toning in patches. Citric acid (10 grs. per oz.) or oxalic acid (5 grs. per oz.) instead of acetic is an aid to pure whites.

As a means of rendering uranium-toned prints permanent, it is recommended to fix the toned prints for five minutes in hypo, ½ oz; potass. metabisulphite, 70 grs.; water, 20 ozs.

Green Tones.

(*H. E. Smith's formula without scheduled poisons.*)

A.—Potass. ferricyanide	180 grs.	2 gms.
Water, distilled	20 ozs.	100 c.c s.
B.—Vanadium chloride stock solution	3½ drs.	4 c.c s.
Ferric ammonium citrate (*green* scales)	45 grs	1 gm.
Soda citrate neutral (Merck) ..	2½ ozs.	25 gms.
Ammonium chloride	90 grs.	2 gms.
Hydrochloric acid, strong pure..	1½ ozs.	14 c c.s.
Water distilled	10 ozs.	100 c c.s.

The stock vanadium solution is made by mixing 1 oz. of vanadium chloride, as purchased (Merck's syrupy) with 5 drams (12 c c.s) of strong hydrochloric acid and then adding distilled water to make 2 ozs. 90 minims (62 c.c.s.) in all.

In making up the B solution, first add the hydrochloric acid to the vanadium solution. Then dissolve the ferric citrate, soda citrate, and ammonium chloride in the 10 ozs. (100 c.c.s.) water and mix the two. Solution should be dull mauve blue; not green—until mixed with A

Both A and B solutions will keep for months at least.

To mix the toning solution, take, 1 part A with 4 parts water, and, separately, 1 part B with 4 parts water. The two weak solutions when mixed together form the toner.

Prints tone in from 4 to 8 minutes. Rock constantly, then wash in 5 changes of water, each of 2 minutes, give a bath of hydrochloric acid (1 part in 50 parts water) for 2 minutes, and finally wash for 15 minutes in 7 or 8 changes of water.

Prints should be of the ordinary depth. The green tone is permanent.

Blue Tones.

10% solution ferric ammonium citrate	2 ozs	10 c.c.s.
10% solution potassium ferricyanide	2 ozs.	10 c.c.s.
10% solution acetic acid.. ..	20 ozs.	100 c.c s.

The well-washed prints are immersed in this bath until the desired tone is given. Then well wash until high-lights are clear. This bath intensifies the image.

Gold Toning.

This process considerably improves the colour of greenish or rusty black prints, and if allowed to act for some time bluish tones are obtained.

Ammonium sulphocyanide ..	30 grs.	2 gms.
Chloride of gold	2 grs.	0·13 gm.
Boiling water	4 ozs.	110 c.c.s.

Use as soon as cool. Place the wet print face upwards on a sheet of glass, squeegee into contact, blot off superfluous moisture, and paint the above bath on with a broad flat brush; when the desired tone is reached wash well and dry.

* * * * *

Practically all the above toning solutions can be employed for antern plates.

Line Drawings from Bromide, Gaslight, or P.O.P. Prints.

After outlining the subject in waterproof Indian ink, bleach out the image in—

Thiocarbamide	240 grs.	25 gms.
Nitric acid	4 drs. (fl.)	25 c.c.s.
Water	20 ozs.	1,000 c.c.s.

Or in—

Iodine sol. (10 per cent. in potass. iodide sol.)	30 minims	6 c.c.s.
Potass. cyanide (10 per cent. sol. in water)	5 minims	1 c c.
Water	1 oz.	100 c.c.s.

THE CARBON PROCESS.

Procedure.—Tissue, *i.e.*, paper coated with a mixture of gelatine and pigment colour, is made sensitive by immersion in bichromate solution, dried, and printed under the negative by daylight. As the colour of the tissue hides the effect of light, the printing is done by aid of an actinometer.

The effect of the light is to render the gelatine insoluble—deeper down into the tissue, the greater the action. "Development" consists in dissolving out in warm water the tissue which remains soluble, As a skin of insoluble tissue is formed over the whole top surface of the print, the coating is first transferred (face down) on to a fresh support. To do this, the exposed tissue is soaked in cold water along with a sheet of (gelatine-coated) transfer paper, the two squeegeed together, put under pressure for about 20 minutes, and then placed in

hot water. The original support of the sensitive surface is stripped off, leaving the tissue with its face (the insoluble side) on the transfer paper. The soluble gelatine can be then dissolved away (development), carrying the pigment with it, and the prints are finally passed through an alum bath, washed and dried As this transference of the print to a new support causes the picture to appear reversed as regards right and left, it is necessary (where this is an objection) to transfer first on to a "temporary support," and from this again on to the "final support" for development.

Sensitising Solutions.

Potass. bichromate	.. ..	1 oz.	35–50 gms.
Water	.. ..	20–30 ozs.	1,000 c.c.s.
Liquor ammonia (0·880)	.. ..	60 minims	6 c.c.s.

A longer immersion in the weaker solution is practically equal to a shorter one in the stronger bath.

If the tissue is squeegeed on a glass plate after sensitising, the degree of squeegeeing (light or heavy) also modifies its sensitiveness by removing more or less of the solution. If the tissue be squeegeed on to a ferrotype plate, and allowed to dry upon it, the drying may be done in the light of an ordinary room. The face of the tissue is then protected from light, dust, and injurious vapours.

The following has been recommended:—

Potass. bichromate	.. ..	1 oz.	20 gms.
Water	.. ..	50 ozs.	1,000 c.c.s.
Citric acid	.. ..	¼ oz.	5 gms.
Liquor ammonia	.. .. ..	q.s. to change tint of solution to lemon yellow.	

This bath is suitable for thin negatives, *i.e.*, those lacking in contrasts, and the tissue sensitised in it will keep longer than that sensitised in the former solution. The tissue, however, is much less sensitive, and with vigorous or contrasty negatives, such as are best suited for carbon work, it is apt to yield prints that are hard, through the washing away of the more delicate tones in the development.

Fixing or Hardening Bath.

Alum	.. ..	1 oz.	50 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

Waxing Solutions.

For Carbon Prints, or for Removing Collodion Films.

No. 1.—Beeswax	.. .. ..	20 grs.	10 gms.
Benzole rect. No. 1	.. ..	4 ozs.	1,000 c.c.s.

For Flexible Supports (Autotype).

No. 2.—Yellow resin	.. .. ..	180 grs.	42 gms.
Yellow beeswax	.. ..	60 grs.	14 gms.
Rectified spirits of turpentine		10 ozs.	1,000 c.c.s.

Gelatine Solutions.

For transferring carbon pictures from flexible support to ivory, opal, glass, &c.

Nelson's No. 1 gelatine	1 oz.	50 gms.
Water	1 pint	1,000 c.c.s.
Chrome alum, dissolved in 2 ozs. (100 c.c.s.) hot water	12 grs.	1 4 gm.

For coating drawing-papers for the single transfer process—

Nelson's No. 1 gelatine	1 oz.	50 gms.
Water	1 pint	1,000 c.c.s.
Chrome alum, dissolved in 2 ozs. (100 c c.s.) water	20 grs.	2·3 gms.

Apply with a brush.

Note.—In adding a solution of chrome alum to one of gelatine, both solutions should be at a fairly high temperature, 130 degrees to 160 degrees F.

SUBSTRATUM FOR CARBON TRANSPARENCIES.

Nelson's No. 1 gelatine	¾ oz.	37 gms.
Water	20 ozs.	1,000 c.c s.
Potass. bichromate	12 grs.	1·4 gm.

Well cleaned plates are coated with this and dried, when they are fully exposed to light, which will render the coating insoluble.

TO REMOVE BICHROMATE STAINS FROM FINGERS, NAILS.

Apply dilute ammonia to the parts until the stains disappear, then well wash the hands with warm water and soap.

THE OIL PROCESS.

Procedure.—Gelatine-coated paper is sensitised with bichromate, printed under the negative, and treated in cold water. The faint image has the power of fixing greasy ink. This is applied with a brush, usually accentuating or suppressing parts of the subject at the worker's discretion.

Double-transfer papers, as used in the carbon process or other papers (gelatine-coated), sold for the purpose, are sensitised in a solution of bichromate of potash of 5 per cent. strength as for carbon printing. The citric acid sensitiser given above under "Carbon" is very suitable, but the most satisfactory method on the whole is the use of a quick-drying spirit sensitiser.

SPIRIT SENSITISER.

(Demachy)

Prepare 6 per cent. ammonium bichromate by dissolving 1½ ozs. of this salt in 25 ozs. of water.

To make the sensitiser mix at time of use:—

Stock bichromate solution	1 part
Alcohol, pure, 90°	2 parts

The sensitiser is applied with a flat hog-hair brush, about ¾ oz. serving for six 10 × 8 sheets of transfer paper.

The paper dries in about 18 minutes, and is printed under the negative until it shows a brown image as in the platinum printing process. The detail should show in the high-lights. It is then soaked in several changes of water to remove the yellow bichromate (about 20 minutes), and then soaked for a further time (in a dish of water), depending on the thickness of the gelatine coating. An average time is 30 minutes; 2 to 3 hours for more heavily coated papers. The temperature of the water should be between 65° and 70° F., and should be kept steady by placing the dish in a place at this temperature. The print can be pigmented forthwith, or dried for pigmenting later on. If it is dried it requires about an hour's soaking in water at 65° to 70° F. to bring it into the best condition for pigmenting.

THE BROMOIL PROCESS.

In this form of the oil process a bromide print or enlargement is treated so as to remove the image and at the same time bring the print into the same condition as that produced by exposure of sensitised paper in the oil process.

C. Welborne Piper's Formula.

The bromide enlargement must be fully exposed and developed, using a slow-acting amidol developer for preference, and it must be thoroughly fixed, washed, and dried. It is then bleached in—

Ozobrome solution	4 parts
Potash alum, 10% solution	4 parts
Citric acid, 10% solution	1 part
Water to make	20 parts

It is washed and then immersed in sulphuric acid (1 part to 20 water) for from 2 to about 5 minutes, again washed by soaking for a few minutes, and then fixed for 2 or 3 minutes in—

Hypo	2 ozs.
Soda sulphite	½ oz.
Water to make	20 ozs.

After this it is washed again and then pigmented like an ordinary oil print. The solutions and washing water used should not be under 60 deg. or over 70 deg. F., and the preparation of the print should not occupy longer than 20 minutes.

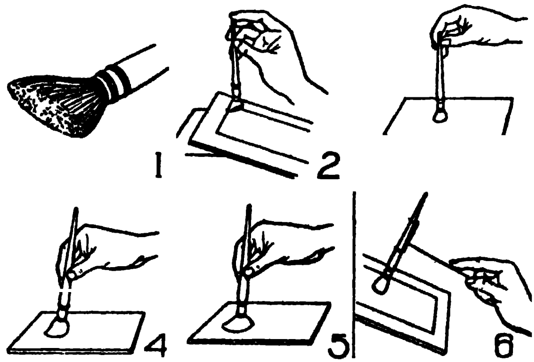
The ozobrome solution used is that specially supplied for bromoil by the Ozobrome Company.

The above is the process originally published by Mr. Welborne Piper, and is still as reliable a method as any. For alternative bleachers, &c., which have been proposed, see "Epitome of Progress," B J.A., 1909, p. 618; 1910, p. 571; 1911, p. 587; 1912, p. 628; 1913, p. 672; 1914, p. 671, and under "Bromoil" in the present volume.

Pigmenting Oil and Bromoil Prints.

The brush chiefly used is the pied de biche, or hare's foot, of dome shape (Fig. 1).

In dabbing on pigment, rest elbow on table, press bristles at toe of brush first on paper, and bend and spread a little before heel comes down (Fig. 2).



Another touch is to hold brush lightly between first two fingers and thumb, lower brush on to print, and dab four or five times a second, the brush hardly leaving surface (Fig. 3).

Or hold brush (firmly) lower down (Fig. 4).

And apply vigorously, with slight dragging action, from heel to toe for strong effects (Fig. 5).

In "hopping," hold brush on wire and apply in taps, coming an inch or so from print each stroke (Fig. 6); lightens light and strengthens dark tones.

PLATINUM PRINTING.

In the platinum process, paper is coated with a mixture of sensitive iron (ferric) salts with which are platinum salts. By exposure to light the ferric salts become reduced to ferrous salts, andthen are able to reduce the platinum in the paper as a black or sepia deposit, forming a highly permanent print. The "developer" in which this takes place is a solution by which the ferrous salts are brought into a soluble state. The developer is used hot or cold, according to the nature of the paper and the kind of tone required.

Sensitisers for Cold Bath Papers (Hübl).

Stock Solutions.

Standard Iron Solution.—In glass measure about 3 ins. diameter and 12 ins. high (marked to show a volume of 85 c.c.s.), place 52 gms. powdered iron ammonium alum, and add about 20 c.c.s. ammonia (0·880) and 20 c.c.s. water. Stir up the alum powder with a glass rod, and allow to stand several minutes, with frequent shaking. The whole should smell slightly of ammonia; if it does not a little more is added. The measure is then filled with water, the precipitate of ferric hydroxide stirred up, the glass rod removed, and the ppt. left to settle. The clear liquid is poured off, fresh water poured on, and the stirring and settling repeated until the solution no longer colours red litmus-paper blue. Powdered oxalic acid (21·5 gms.) is then dusted on the ppt., after pouring off the last washing water, and (in yellow light from this point) stirred in until the mixture clears. It is poured into a 100 c.c. measure, and diluted (with rinsings from the cylinder) to 100 c.c.s. Process occupies three to four hours.

Lead-Iron Stock Solution.—Dissolve lead acetate (10 gms.) in warm water (100 c.c.s.), and add oxalic acid (4 gms.) dissolved in a little water. A white precipitate of lead oxalate is produced, and is filtered, washed, and shaken up, with Standard Iron Solution in proportion of 1 gm. per 100 c.c.s. Finally, filter.

Oxalic-Gelatine Solution. — Soak gelatine (2 gms.) in water (20 c.c.s.), and add oxalic acid (½ gm.). Warm before use. Keeps only a day or two.

Stock Platinum Solution.—Potash chloroplatinate, 1 gm.; water, 6 c.c.s.

Mercury Citrate Solution.—Dissolve yellow mercuric oxide (1 gm.) in water, 20 c.c.s.; citric acid, 5 gms.. warm and filter.

Sensitisers.

The quantities are for a 20 by 30 inch sheet. Water is added for medium (2 to 3 c.c.s.) and for rough (3 to 8 c.c.s.) papers.

A.—Lead-iron solution	4·5 c.c.s.
Stock platinum solution	3 c.c.s.

For black tones on gelatine-sized Rives papers.

B.—Lead-iron solution	4·5 c.c.s.
Stock platinum solution	3 c.c.s.
Oxalic-gelatine solution	1 c.c.

For blue-black tones on arrowroot-sized papers.

For more brilliant prints 5 to 10 drops of 10% solution of sodium chloroplatinate are added to either of the above.

Sepia Paper Sensitisers.

Hot Development.

Standard iron solution	6 c.c.s.
Stock platinum solution	4 c.c.s.
Mercuric chloride (1 in 20 solution)	0·2 to 1 c.c.
Sodium chloroplatinate (10% solution) ..	2 to 10 drops.

COLD DEVELOPMENT.

Standard iron solution	8 c.c.s.
Stock platinum solution..	4 c.c.s.
Mercury citrate solution..	1 to 4 c.c.s.
Sodium chloroplatinate (10% solution) ..	2 to 5 drops.

For rough papers 2 to 4 c.c.s. of water are added.

Procedure in the Platinum Process.—Prints are developed by floating for from 15 seconds to 1 minute on a bath, the chief chemical in which is always potash oxalate. Without washing, they are placed in a bath (No. 1) of 1 in 80 pure hydrochloric acid for 5 minutes, into a second bath for 5 minutes, again into a third, and are then washed in running water for 15 minutes. Time in all, about half-an-hour.

Cold Bath Developers.

Potass. oxalate	2 ozs.	100 gms.
Potass. phosphate..	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.

FOR SEPIA TONES ON COLD BATH BLACK PAPER.

A.—Potass. oxalate	2 ozs.	20 gms.
Water	15 ozs.	150 c.c.s.
B —Potass. citrate	160 grs.	23 gms.
Citric acid	250 grs.	39 gms.
Mercuric chloride..	95 grs.	14 gms.
Water	15 ozs.	1,000 c.c.s.

Equal parts of A and B, used slightly warm. The prints are afterwards fixed in acid baths of one-third the usual strength.

Another Formula.

Prepare the following solutions:—

1.—Potass. oxalate	4 ozs.	250 gms.
Distilled water	16 ozs.	1,000 c.c.s.
2.—Cupric chloride	124 grs.	35 gms.
Distilled water	8 ozs.	1,000 c.c.s.
3.—Mercuric chloride..	1 oz.	62 gms.
Distilled water	16 ozs.	1,000 c.c.s.
4.—Lead acetate	32 grs.	18 gms.
Distilled water	4 ozs.	1,000 c.c.s.

Mix 12 parts of No. 1 with 4 parts No. 2, then add 4 parts No. 3 and 1 part No. 4, and heat till the precipitate first formed is redissolved. The solution should be heated to 175 degrees F., and the prints developed in it in the usual way and treated to the usual acid clearing baths, then immersed in ammonia solution (about 10 minims per oz.) for 5 minutes, and washed and dried.

Developer for Sepia Paper.

HOT BATH.

Potass. oxalate	2 ozs.	100 gms.
Potass. phosphate..	1 oz.	50 gms.
Citric acid	180 grs.	20 gms.
Potass. chloride	90 grs.	10 gms
Water	20 ozs.	1,000 c.c.s

Various Platinum Formulæ.

RECOVERING OVER-EXPOSED PRINTS.

Immerse for about two minutes in the oxalate developer. Transfer for one second to a bath of 1 to 20 hydrochloric acid. Return to the developer, and treat as usual.

INTENSIFIER FOR PLATINUM PRINTS.

A.—Sodium formate		45 grs.	100 gms.
	Water	1 oz.	1,000 c.c.s.
B.—Platinum perchloride		10 grs.	1 gm.
	Water	1 oz.	45 c.c.s.

Add 15 minims each of A and B to 2 ozs. of water (3 c.c.s. to 100 c c.s.).

RESTORING YELLOWED PRINTS.

Shake up bleaching powder with about five times its weight o water, pass through a sieve, and to the portion which passes through add a little weak hydrochloric acid—enough to give the mixture a faint chlorine smell. The solution removes the yellow (iron) stain from platinum prints.

CLEANING SOILED PRINTS.

Alum (one teaspoonful) is dissolved in about 8 ozs. of water, and mixed in a basin with a handful of flour to a cream-like consistency This mixture is applied to the platinum print with a soft brush, and washed off in running water.

PLATINUM RESIDUES.

Exhausted developers—and the acid baths if in quantity—are mixed in a large jar, with zinc and hydrochloric acid (spirits of salt will do). A dirty chalk-like precipitate is accumulated, and the clear liquor is thrown away. The platinum is precipitated in the mud, and the latter, when enough has accumulated, is sent to the refiners, after being drained from water as much as possible on a linen cloth.

Waste prints, clippings from paper, etc., should be sent as they are or burnt to an ash in a place free from draught, such as a biscuit tin with a row of holes about half way up. They should not be mixed with the wet residues, as the two require different treatment for the extraction of the metal.

IRON PRINTING PROCESSES.

Ferro-Prussiate Sensitiser.

This ferro-prussiate or "blue" paper gives prints of Prussian blue colour from ordinary (brilliant) negatives. From line drawings, plans, etc., it supplies copies in white lines on a blue ground.

A.—Ferric ammonium citrate (green)*	110 grs.	250 gms.
Water	1 oz.	1,000 c.c.s.
B.—Potass. ferricyanide	40 grs.	90 gms.
Water	1 oz.	1,000 c.c.s.

Mix in equal parts, keep in the dark, and filter just before use.

The sensitiser is applied with a brush or sponge. The paper is printed until the shadows bronze, and is "developed" simply by soaking in one or two changes of plain water.

Solution for Writing Titles on, removing blue lines from, blue prints, etc.—Potass oxalate, 75 grs. per oz.; 170 gms. per 1,000 c.c.s.

Brightening the Colour.—Blue prints are improved in colour by a final bath of 2½ per cent. alum solution, 3 per cent. oxalic acid, or 1 per cent. hydrochloric acid.

The Kallitype Process.

Paper, sensitised as below, is printed to a semi-visible image, like platinum paper. It yields prints from black to sepia, according to the developer. If prints are fixed in a mixture of hypo and ammonia, the results appear to be permanent.

Sensitiser.

Ferric oxalate (Merck pure and fresh) 20% sol.	1 oz.
Ferric potass. oxalate, 1 : 16 sol.	¼ oz.
Oxalic-ammonia sol. as below	30 minims
Potass. bichromate, 1 : 16 sol.	4 drops
Silver nitrate	36 grs.

The oxalic-ammonia solution is :—Oxalic acid, 240 grs.; ammonia, ·880, 100 minims; water, 4 ozs.

Paper thus sensitised yields prints of full gradation and half-tone from ordinary negatives, such as print well in P.O.P. For flat negatives further bichromate solution may be used in the developer.

* If the ordinary brown citrate be used, the formula should contain 80 grs 188 gms.), and the ferricyanide should be increased to 60 grs. (137 gms.).

Developers.

For Black Tones.

Borax	2 ozs.	100 gms.
Rochelle salt	1½ ozs.	75 gms.
Water	20 ozs.	1,000 c.c.s.
Potass. bichromate sol. (1%) ..	15–18 drs.	90-115 c.c.s.

For Purple Tones.

Borax	½ oz.	28 gms.
Rochelle salt	2 ozs.	100 gms.
Water	20 ozs.	1,000 c.c.s.
Potass. bichromate sol (1%) ..	15–18 drs.	90–115 c.c.s

For Sepia Tones.

Rochelle salt	1 oz.	50 gms.
Water	20 ozs.	1,000 c.c.s.
Potass. bichromate sol. (1 %) ..	8–10 drs.	50 60 c.c s.

Prints are allowed to remain in either of the above developers for from 15 to 30 minutes.

For Black Tones.

Sodium acetate	3 ozs.	150 gms.
Water	20 ozs.	1,000 c.c.s.

From this developer prints must be passed into a bath of potass oxalate (15 %) before fixing.

Fixing Solution.

Hypo	1 oz.	200 gms.
Ammonia (0·880)	120 minims	12 c.c.s.
Water	20 ozs.	1,000 c.c.s.

Prints are left in this for at least 10 minutes.

Sepia Paper.

This process and the single-solution sensitiser given below may be used for printing from ordinary negatives, but the results are deficient in gradation. Both are excellent for making duplicates of plans, etc , and give a copy in white lines on a brown ground from an ordinary tracing. This copy may be used as a negative for preparing further "positive" copies.

A.—Ferric ammonia citrate (green)..	110 grs.	250 gms.
Water	1 oz.	1,000 c.c.s.
B.—Tartaric acid	18 grs.	40 gms.
Water ..	1 oz.	1,000 c.c.s.
C.—Silver nitrate	45 grs.	100 gms.
Water ..	1 oz	1,000 c.c.s.

D.—Gelatine	.. ..	30 grs.	70 gms.
Water	.. ..	1 oz.	1,000 c.c.s.

Equal parts (say 1 oz. of each) of these solutions are mixed as follows:—D is rendered just fluid on a water bath, A and B added, and lastly C, a few drops at a time. The prints are fixed in 1: 50 hypo.

One-Solution Sepia Sensitiser.

Silver nitrate	.. .. ..	55 grs.	3·5 gms.
Water	.. ..	4-5 drs.	15-20 c.c.s.

Add ammonia drop by drop just to re-dissolve the white precipitate, and then a little sulphuric (or citric) acid just to remove the odour of ammonia. Then add—

Ferric ammonium citrate (green)		40 grs.	2 5 gms.
Water	.. ..	6 drs.	25 c c.s.

This solution keeps in the dark, and is used like the four-solution mixture.

Pellet Process.

The Pellet process is for copies of line drawings only From an ordinary tracing it gives a copy in blue lines on a white ground

A.—Pure gum arabic	.. .. ..	4 ozs.	200 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.
B.—Ferric ammonium citrate	..	10 ozs.	500 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.
C.—Ferric chloride (crystallised)	..	10 ozs.	500 gms.
Water	.. ..	20 ozs.	1,000 c.c.s.

Add 8 vols of B, then 5 vols. of C to 20 vols. of A, in small doses with constant stirring.

The prints are developed on 10 per cent. solution of potass. ferrocyanide and "fixed" in 1 : 25 sulphuric acid (specific gravity 1·84).

The Ferro-Gallic Process.

This process is for line drawings only. It gives a copy, in bluish-black lines on a white ground, from an ordinary tracing

Gum arabic	.. .. ..	60 grs.	135 gms.
Warm water	.. .. ..	1 oz.	1,000 c.c s.

When dissolved add the following in the order given:—

Tartaric acid	.. .. ..	8 grs.	18 gms.
Salt ..	.. ..	36 grs.	81 gms.
Ferric sulphate	.. .. ..	40 grs.	90 gms.
Ferric chloride	.. .. ..	60 grs.	135 gms.

The developer for the prints is:—Alum and gallic acid, 1 part of each; water, 80 parts.

MOUNTANTS.

Starch Paste.

Pure starch is mixed with a very small proportion of cold water to form a very stiff mass. It should be so stiff that it is stirred with difficulty. Perfectly boiling water is then poured in, about 12 ozs. for every ounce of starch. On stirring, the mixture will jellify without being boiled; but if it does not it is brought to the boil, cooled, the skin taken off, and the paste used on day of making.

Gelatine.

For mounting prints without cockling.

Nelson's No. 1 gelatine	4 ozs.	50 gms.
Water	16 ozs.	200 c.c.s.

Soften the gelatine in the water, liquefy on the water bath, and add a little at a time and stirring rapidly:—

Methylated spirit	5 ozs.	30 c.c.s.
Glycerine	1 oz.	6 c.c.s.

The mountant is used hot. A piece of ground glass is dipped in hot water, drained, and the mountant brushed over. The print is then laid face up on the pasted surface and rubbed gently in contact with a piece of paper, being then removed and pressed down on its mount.

Dextrine Paste.

Dextrine, best white..	2¾ lbs.	1,400 gms.
Water at 160° F.	80 ozs.	2,550 c.c.s.
Oil of wintergreen	15 minims	1 c c
Oil of cloves	15 minims	1 c.c.

Place the water in a vessel standing in a larger vessel of water kept to within 1° of 160° F. Stir in the dextrine slowly, and when it has all dissolved add the two preservative oils, stirring all the time. Then allow to cool, pour into bottles, and cork. Put aside in a cool place for a week or two for the mixture to congeal to a firm white smooth paste.

Starch-Gelatine.

A.—Bermuda arrowroot	8 ozs.	200 gms.
Water	4 ozs.	100 c.c.s.
B.—Nelson's No. 1 soft gelatine ..	360 grs.	10 gms.
Water	64 ozs.	800 c.c s.

The gelatine is first softened in the water and A and B are then mixed together and boiled for a few minutes. To the cold mixture are stirred in—

Methylated spirit	5 ozs.	250 c c.s.
Carbolic acid (liquid)	25 minims	3 c.c.s

This is a good cold paste, which sticks and keeps fairly well.

Liquid Gelatine.

Gelatine	1 oz.	100 gms.
Water	6 ozs.	600 c.c.s.
Chloral hydrate	1 oz.	100 gms.

The gelatine is dissolved in the water by aid of heat, and the chloral hydrate added. After digesting for a short time the adhesive liquid is neutralised with a little sodium carbonate solution.

Gum-Dextrine.

Picked white gum arabic ..	½ oz.	65 gms
Dextrine	2¼ ozs.	280 gms.
Liquid ammonia	4 drops	50 c.c.s.
Carbolic acid	1 dr	15 c.c.s.
Water	8 ozs.	1,000 c.c.s.

The gum is powdered in a mortar and mixed intimately with the dextrine, and rubbed with 2 ozs. of water until a smooth mixture is obtained. The remainder of the water is added, and the whole boiled for 10 minutes. The ammonia and carbolic acid are added when cold. This mountant keeps well for months, and is smooth in working and of great adhesiveness.

Shellac Mountant.

A strong solution of shellac in methylated spirit, or, better, rectified spirit, is thinly applied to both mount and print, and the two coated surfaces quickly rubbed into contact. A good method of fixing prints to thin mounts in albums, etc.

Affixing Paper to Metal.

Tragacanth	3 ozs.	60 gms.
Gum arabic	12 ozs.	240 gms.
Water	50 ozs.	1,000 c.c.s.
or—		
Gum arabic	1 oz	100 gms.
Aluminium sulphate	45 grs.	10 gms.
Water	10 ozs.	1,000 c.c.s

Mounting on Glass (Opalines).

Nelson's No. 2 soft gelatine ..	2 ozs.	30 gms.
Water	20 ozs.	300 c.c.s.

The gelatine is soaked in the water, and liquefied by standing the vessel in hot water. The solution is thinned down until nearly as thin as water. Print and glass are immersed, removed together, and squeegeed together with flat rubber squeegee.

WORKING UP, COLOURING, ETC., PRINTS.

Lubricant for Burnishing Prints.

Powdered Castile soap	20 grs.	5 gms.
Alcohol	10 ozs.	1,000 c.c.s.

Encaustic Paste.

Purified beeswax	50 parts
Oil of lavender..	30 parts
Benzole..	30 parts
Gum elemi	1 part

BASKETT'S FORMULA.

To the contents of a 2d. tin of Globe polish add 1 oz. best olive oil and 1 oz. terebine. Apply with soft cloth and polish.

Preparing Prints for Colouring.

P.O.P.'S AND GLOSSY BROMIDES.

Rub the prints lightly with a tuft of wool slightly moistened with artist's purified ox-gall. If they have been lubricated before burnishing apply previously a little alcohol in the same way.

COLLODION PRINTS.

Fluid extract of quillaia	1 dr.	5 c.c s.
Water	1 oz.	40 c.c.s.
Alcohol	1 oz.	40 c.c.s.

BROMIDES.

For Water Colouring.

Apply ox-gall as directed for P.O.P., or prepare as directed below for pastel work.

For Oil Colouring.

If the surface is clean no preparation is needed ; if otherwise give a wash of gum, starch, or gelatine, or prepare with pumice powder. Also light drying oil (from the artists' colourman) may be rubbed over with a tuft of wool or the fingers. It dries in about twenty-four hours, and leaves the surface of the bromide ready for painting.

For working up in pastel or black and white, apply fine pumice powder with a tuft of wool, and *remove* with another piece of wool or a duster.

Fixative for Crayon and Pastel Work.

A.—Mastic	24 grs.	1·6 gm.
Amyl acetate	3 ozs.	85 c.c.s.

Dissolve by agitation, and allow to stand some hours before use,

B.—Celluloid (film clippings free from emulsion will do)	.. ..	7 grs.	0·45 gm.
Amyl acetate	.. .. ..	3 ozs.	85 c.c.

Dissolve by agitation. Mix when both are clear, and keep in tightly-corked bottle. Apply with spray diffuser.

Colouring Prints with Dyes.

Dissolve the aniline colour (1d. packets of dye will do) in a sufficient quantity of water (from ½ to 1 oz. to a 1d. packet), and for glossy prints add a little gum. If the work affects the gloss when finished, rub the print over with a piece of wool slightly moistened with a solution of wax in benzole.

Colouring Prints with Artists' Water Colours.

The following are suitable colours for bromide enlargements, platinum, and carbon prints. The colours in ordinary type are permanent; those in italics are more or less doubtful except under special precautions against exposure. Those marked * are transparent.

*Alizarin Scarlet.
Flesh Tint, No. 1.
Flesh Tint, No. 2.
Flesh Tint, No. 3
*Indian Red.
*Rose Madder.
Venetian Red.
Vermilion.
*Antwerp Blue.
Cobalt Blue.
*French Ultramarine
Indigo.
*Prussian Blue.
**Brown Pink.*
*Burnt Sienna.
Cadmium Yellow.
Chrome Lemon
Chrome Orange
*Indian Yellow
Naples Yellow.
*Raw Sienna.
Roman Ochre.
Yellow Ochre.
Emerald Green.
**Hooker's Green, No. 2.*
Terre Verte.
**Brown Madder.*
Payne's Grey.
Raw Umber.
Sepia.
**Vandyke Brown.*
Ivory Black.
Lamp Black.
Chinese White.

Colours for Air-brush Work.

The following is a list of the most useful colours for air-brush work.—

Blanc d'Argent, No. 2.
Burnt Sienna
Burnt Umber.
Charcoal Grey.
Chinese White.
Chrome Lemon.
Chrome Yellow.
Chrome Deep
Chrome Orange.
Cologne Earth.
Emerald Green.
Indian Red.
Lamp Black
Light Red.
Mauve.
Naples Yellow.
Neutral Tint.
Permanent Crimson.
Permanent Green.
Permanent Scarlet.
Prussian Blue.
Raw Sienna.
Raw Umber.
Ultramarine, Light.
,, Middle.
,, Deep.
Vandyke Brown.
Vermilion.
Yellow Ochre.
Brown Madder.
Emerald Oxide of Chromium
Indian Yellow.
Sepia.

Spotting Bromide Prints.

Mix together Payne's grey and Indian ink (the colour should match that of the film).

Spotting P.O.P. Prints.

Add a little carmine to the above. When mixture is dry (on the palette) work in a strong solution of gum, rubbing the brush one way only, to avoid making air-bells. If the prints are to be enamelled or glazed by stripping after spotting, then artists' oil colours with benzole in which gum dammar has been dissolved, or water colours, may be used with shellac water varnish. (See "Negative Varnishes.")

Colouring from Behind (Crystoleum).

The print (which should be albumen) is mounted with a warm solution of:—

Hard gelatine	20 grs.	45 gms.
Water	1 oz	1,000 c.c.s.

containing a little salicylic acid to keep it. Or with a cold mountant made by mixing the above with an equal volume of starch paste.

VARNISH FOR "TRANSLUCING."

Canada balsam	5 ozs.	100 gms.
Solid paraffin	2 ozs.	40 gms.
White wax	2 ozs.	40 gms.

which is melted, the picture immersed, and the whole kept as cool as possible consistent with remaining fluid.

COLOUR PHOTOGRAPHY.

The following are the official working instructions for the screen-plates freely in the market at the time of sending this portion of the ALMANAC to press (September 15, 1914).—

The Autochrome Plate.

SIMPLIFIED METHOD OF DEVELOPMENT.

Two solutions only are used—developer (used also for re-development) and reversing solution. There is no need to fix.

Developer—Stock Solution.

A.—Water, distilled	35 ozs.	1,000 c.c.s.
Metoquinone (Quinomet)	½ oz	15 gms.
Soda sulphite, anhydrous	3½ ozs.	100 gms
Liquor ammonia, 920	9 drams	32 c.c.s.
Potass. bromide	90 grs.	6 gms.

Dissolve the Quinomet in warm water (about 100° F.), add the sulphite, and then, when cold, the ammonia.

Working developer. Stock solution, above, 1 part; water, 4 parts.

For correct exposure, time of development is 2¼ minutes exactly; then rinse and immerse in reversing solution, C below

Where exposure may not be correct, it is best to develop by the following table, allowing of errors being compensated for:—

For half-plate, place in developing dish.

C D.—Stock solution, A above	85 minims	5 c.c.s.
Water	2½ ozs.	80 c.c s.

Have ready in one measure-glass—

Stock solution, A above..........	½ oz.	15 c.c.s.

and in another—

Stock solution, A above	1½ ozs	45 c.c s.

These are placed near the lamp, one or the other quantity of the developer being quickly added to that in the dish, according as the plate comes up quickly or slowly

Immerse the plate in solution CD, and count the number of seconds elapsing before the first outlines of the image appear (disregarding the sky) by looking at the plate rapidly without taking it out of the dish. Immediately these outlines are discernible, pour into the dish either 15 c c s. (½ oz), or 45 c c.s. (1½ oz) of A, whichever may be necessary according to the following table, continuing to count the seconds —

Appearance of outlines of image (disregarding sky) after immersion		Quantity of developer A to add on appearance of first outlines	Total duration of development from immersion of plate	
	Seconds		Minutes	Seconds
	12 to 14	15 c.c s. (½ oz.)	1	15
	15 to 17	do. do.	1	45
	18 to 21	do. do	2	15
	22 to 27	do. do.	3	0
	28 to 33	do. do.	3	30
	34 to 39	do. do.	4	30
Extreme under-exposure	40 to 47	45 c c (1½ ozs.)		
	Above 47	45 c.c. (1½ ozs)		

For a quarter-plate use one-half the above quantities.

Reversing Solution.

C.—Potassium permanganate	30 grs	2 gms.
Sulphuric acid	3 drams.	10 c.c.s.
Water	35 ozs.	1,000 c.c.s.

This solution will keep for a short time, but should not be used if cloudy.

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Immediately the plate is covered by the C solution daylight may be used. After 3 or 4 minutes, wash for 30 seconds in running water

In summer it is well to put the plate, after leaving the C bath, for 2 minutes into a solution of chrome alum, as follows —

Chrome alum	150 grs.	10 gms.
Water	35 ozs	1,000 c.c.s.

The plate should be rinsed before placing in the second developer, or, if desired, it may be dried and re-developed after a day or two.

Second Development.—The plate is then re-developed in full daylight, using the solution which has served for the first development (kept in the dish without special precautions). When the high-lights are completely darkened (about 3 or 4 minutes) the plate is washed for 3 or 4 minutes, and immediately placed to dry Fixing is unnecessary unless the plate is intensified.

PYRO DEVELOPMENT.

The following method, which was that originally advised for the development of Autochrome plates, is still preferred by some workers The solutions are as follows —

FIRST DEVELOPMENT.

A.A.—	Water	$3\frac{1}{2}$ ozs	100 c c s.
	Soda bisulphite solution ..	2 drops	2 drops
	Pyro	45 grs.	3 gms
	Potass bromide	45 grs	3 gms.
B.B.—	Water	3 ozs.	85 c c s.
	Soda sulphite, anhydrous	3 drams.	10 gms.
	Ammonia ·920	$\frac{1}{2}$ oz.	15 c.c.s
Working developer —			
	Water	$3\frac{1}{2}$ ozs.	100 c c.s.
	A.A.	3 drams.	10 c c s
	B.B.	3 drams	10 c c.s.

This developer serves for once only. Time of development (for correct exposure), $2\frac{1}{2}$ minutes exactly at 60° to 65° F

REVERSING BATH

C.—As given above, and used as there directed.

SECOND DEVELOPMENT.

D.—	Water, distilled..................	35 ozs.	1,000 c.c.s.
	Soda sulphite, anhydrous	$\frac{1}{2}$ oz.	15 gms.
	Dianol (Diamidophenol)	75 grs.	5 gms.

After a rapid washing, the plate is placed in the Dianol (Diamidophenol) developer D for 3 or 4 minutes. This should be performed in a strong light, and continued until the white portions are completely blackened Over-development need not be feared

There is no need for fixing the plate after the second development. It only requires washing, drying, and varnishing

CONTROLLED DEVELOPMENT WITH PYRO

Make a quarter-strength pyro solution, viz.—

bb	Solution B B....	1 part
	Water	3 parts

To make working developer for a half-plate take.—

Solution A.A.....	3 drams.	10 c c s.
Solution *b b*	3 drams	10 c c.s
Water	3 ozs.	80 c c s

And have ready in a small graduated measure 1½ oz (45 c c s) of *b.b.* solution, to be added wholly or partly to the bath during development, if necessary.

As soon as the plate is in the dish, count the number of seconds from the moment of entering until the appearance of the first outlines of the image. The sky, however, should not be taken into consideration

It is unnecessary to view the plate by the light of the lantern until 20 seconds have elapsed, as whatever be the degree of exposure the first forms will not be seen before 22 seconds

The number of seconds elapsing before the appearance of the image is the guide to the further development of the plate, which should be carried out according to the following table —

Time of first appearance of image (not counting sky).	Quantity of ammonia solution *bb*, i e, diluted to quarter strength, to be added after image appears	Total time of development, including time of appearance.	
Seconds	C c s	Minutes	Seconds
22 to 24	None	2	0
25 to 27	2	2	15
28 to 30	8	2	30
31 to 35	15	2	30
36 to 41	20	2	30
42 to 48	25	2	30
49 to 55	30	2	45
56 to 64	35	3	0
65 to 75	40	4	0
over 75	45	5	0

The additional quantity of *bb* solution must be added when the outlines begin to appear

We see by the above that, for example, when the image takes 28 seconds to appear we add 8 c c.s of *bb* solution and continue development until the expiration of 2 minutes 30 seconds from the time the plate was put in the dish.

INTENSIFICATION.

If, after the second development, the plate does not show sufficient contrast and brilliancy, it may be much improved by intensification.

This operation may take place at the time of development or be delayed, if desired, till a later time

Whichever plan is followed, all traces of the developer must be first destroyed by the following operation:—

Oxidation.

Immerse the plate for 10 or 15 seconds (after a wash of similar duration) in solution E, composed of:—

E.	Water	35 ozs.	1,000 c.c.s
	Solution C (Acid Permanganate)	5 drams	20 c.c.s.

which oxidises any traces of developer remaining in the coating, and allows proper intensification. Then wash the plate for a few seconds in running water.

For intensification prepare the two following solutions:—

F.	Distilled water	35 ozs.	1,000 c.c.s.
	Pyrogallic acid	45 grs	3 gms.
	Citric acid	45 grs	3 gms.
G.	Distilled water	3½ ozs.	100 c.c.s.
	Nitrate of silver	75 grs.	5 gms.

For use take:—

Solution F	3½ ozs	100 c.c.s
Solution G	3 drams	10 c.c.s.

Immerse the plate in this solution and examine from time to time the increase of intensity. The solution turns yellow little by little, and eventually becomes turbid. It should be used as quickly as possible, and rejected when turbidity makes its appearance.

Usually intensification is complete before this state is reached, but should it be necessary to continue intensification, fresh solution should be used after a short wash, a few seconds in the oxidising solution (E), and another short wash.

During intensification the whites of the plate may become yellowish (dichroic fog) All traces of this disappear in the following clearing bath.

Clearing.

After intensification, wash the plate for a few seconds and place in the following solution (H) of permanganate, containing no acid Allow this to act from 30 seconds to 1 minute —

H.	Water	35 ozs.	1,000 c.c.s.
	Potass. permanganate	15 grs.	1 gm

Particular care should be exercised that Solution C (Acid permanganate) be not mistaken for Solution H (Neutral permanganate)

Fixing.

After a short wash, fix for about 2 minutes in an acid hyposulphite bath made as follows:—

I	Water	35 ozs.	1,000 c.c s.
	Hypo.	5¼ ozs.	150 gms.
	Soda bisulphite, saturated solution	1¾ ozs.	50 c.c s.

The density of the image should not be reduced by fixing. Should reduction be found, it is caused either by two short second development or exposure to too weak a light during second development. Fixing is indispensable when the plate has been intensified.

WASHING.

A wash for 4 to 5 minutes is sufficient to clear the extremely thin gelatine coating of traces of hyposulphite. The plate is then put to dry. It may be that the whites of the subject still retain a slight yellowish tinge. If so, treatment by Neutral Permanganate (solution H) followed by use of the fixing bath I may be repeated.

The Omnicolore Plate.

The instructions and formulæ are those given above for the Autochrome, the same emulsion being used for both plates.

The Dufay (Dioptichrome) Plate.

FIRST DEVELOPMENT.

The following developer is recommended to the exclusion of all other formulæ —

Water	35 ozs.	1,000 c.c.s.
Metol	90 grs.	6 gms.
Sulphite of soda recrystallised	2½ ozs.	75 gms.
Hydroquinone	30 grs.	2 gms.
Potass. bromide	30 grs.	2 gms.
Ammonia ·880	3½ drams	12 c.c.s.

(Ammonia at ·880 being volatile and liable to loss, it is a convenient practice to dilute it on receipt with an equal bulk of distilled water, and then use double the quantity indicated above.)

For use take equal parts of the above developer and of water. This developer is adapted for automatic development, giving images with full detail and the maximum of intensity The time of development at 60° F. should be 4 to 5 minutes Fresh solution should be taken for each plate developed. The development should be begun in as nearly complete obscurity as possible. In about a minute after immersion in the developer it is permissible to examine the plate by a green safe light. Red light is in no case to be used, and it is advisable to expose the plates to the green light as little as possible. When the image is sufficiently developed, wash for about 20 seconds in running water, then place in the reversing solution.

REVERSING SOLUTION

Water	35 ozs.	1,000 c.c.s.
Potass. bichromate	75 grs.	5 gms.
Sulphuric acid	170 minims	10 c.c.s.

Immediately the plate is covered with this solution admit daylight to the dark room or take the dish to an open door or well-lit window, as the rest of the operations should take place in full daylight. The reduced silver will gradually dissolve in the bichromate solution; the progress of the reversal and the appearance of the real colours may be seen on looking through the plate. When the

reversal is complete, which occupies about two minutes, wash in running water till the yellow stain, due to the bichromate, disappears.

SECOND DEVELOPMENT.

Then commence the second development by replacing the plate in the developer previously used for the first development. The image when it left the reversing solution consisted of a positive image in white silver bromide, which is reduced to a black deposit of silver by the action of the developer and daylight, or, failing that, of strong artificial light. The second development should be continued till the darkening action is complete, which will be in about 3 or 4 minutes in day-light.

FINAL WASHING.

Three or four minutes' washing in running water is sufficient although a longer time is not harmful.

INTENSIFICATION

If over-exposed, the image appears too quickly on the first development, the ultimate result being a thin image with a washed-out appearance. This result may be improved to a certain extent by intensification Bleach thoroughly in.—

Water	20 ozs.	800 c c s.
Alcohol	5 ozs.	200 c c s.
Bichloride of mercury....	1 oz.	40 gms.

Then wash for 5 minutes and blacken in the following solution —

Water	10 ozs	100 c.c.s.
Soda sulphite, recryst.	1 oz.	10 gms.

The Paget Plate.

DUPLICATING METHOD.

A separate panchromatic plate is exposed behind and in contact with a mosaic three-colour taking screen, developed, fixed, washed and dried. From it a positive transparency is printed by contact The transparency is then bound up in register with a mosaic three-colour viewing screen.

EXPOSURE.

The following particulars are given as a rough guide.

Open landscape, in good light with sunshine, stop *f*/8, cap off and on, or about ½ of a second.

Portraiture, head and shoulders only; in diffused light out of doors, stop *f*/8, about 3 seconds.

Instantaneous exposures should not be attempted except in the brightest light, and never with a smaller stop than *f*/6·5, under which conditions the exposure may be about $\frac{1}{10}$th of a second.

Actinometers are a reliable means of calculating the exposure, and the following speed numbers will be found correct —

Watkins	Wynne
15	F24

These numbers represent the speed of the panchromatic plate with filter and taking screen in position ready for exposure.

Development of Negative.

Most developers may be used, provided the resulting negative be clean and soft The best results are obtained with Rodinal, 1 in 30, and development should be complete in 2 minutes.

Unless a green safelight is used development must take place in total darkness. On no account should a red light or one of any colour other than the safe green be used. Development in total darkness presents no difficulty, as if the exposure given is about right, the time of development with Rodinal as given above will be correct.

Rinse the plate and fix in the following bath.—

Hypo	6 ozs.
Potass. metabisulphite . ..	½ oz
Water	20 ozs.

Wash again for about 15 minutes, and put to dry.

Making the Transparency.

To obtain the best results the following conditions must be observed —The transparency should be of black tone, perfectly clear, and free from fog, brilliant and full of detail. These conditions can be secured by using the special transparency plates and developer issued in connection with the process.

Registering Transparency with Viewing Screen

Standing well back in the room, facing the light, the operator holds the two plates together, film to film, the screen being towards him. The latter is then moved very slightly in a circular direction (the transparency being held rigid) until small squares are seen. The same circular direction being maintained the squares will grow larger until they disappear and patches of colour take their place. Continue the movement until a perfectly even tint (it does not matter of what colour) appears all over the transparency. The squares of the screen are now parallel with those of the transparency, and the slightest movement of the screen one way will give the picture in its correct colours. To determine the right direction the operator, still holding the screen and transparency tightly together, should turn them in a slanting position, viewing them from either the top, bottom, right or left, when from one of these points the correct colours will be seen. The screen should be moved very gently in this direction, when the proper colours will gradually appear. Clip the two together with a couple of bull-dog paper clips and bind them securely.

Binding must be carefully done, so as not to alter the position of the screen. Denison's binding strips will be found the best. Bind the two sides not clipped and see that the binding strip is adhering everywhere ; then remove one clip at a time (the transparency should never be without one clip) and clip the sides already bound before binding the remaining two. Leave the clips in position until the binding is perfectly dry.

The viewing screens will register one way only, always lengthways of the plate. Therefore, if it is desired to take a portion of the picture from a large negative, say a quarter plate size from a half plate

negative, the quarter plate transparency must be made lengthways of the negative and not across.

In the case of square cut plates such as $3\frac{1}{4} \times 3\frac{1}{4}$ a line will be found on the edge of the viewing screen showing the "lengthways" of the plate.

MISCELLANEOUS FORMULÆ.

Reversed Negatives by Ammonium Persulphate.

A lantern or other thinly coated slow plate is placed in contact with the negative in a printing frame and a full exposure given such as would be thought advisable in making a soft positive transparency. The plate is developed with a clean working developer (*e.g.*, glycin) until the shadows appear quite black on the glass side of the plate. The time of development may be five times as long as for an ordinary transparency. The latter is then washed and placed in a 2 per cent. solution of ammonium persulphate until the silver image is seen to be removed. The plate is then thoroughly washed and developed in any clean developer containing about half a grain of bromide per ounce. It is then fixed and washed and dried. After the first development the operations may be done in weak daylight or artificial light. The action of the persulphate should be as complete as possible, otherwise a veil is left over the negative The above is a very rapid and economical process. Direct positives, but reversed from right to left, from engravings, etc., may be made in the camera by substituting bromide paper for the plate. The exposure should be full and the development as above. The method has this advantage, that the lines are rendered in the same degrees of black and grey as in the original, a point of some importance, since the lines in an engraving are seldom, if ever, of uniform blackness.

To Recover Fogged (Sensitive) Dry-Plates.

Soak for 15 minutes in the following bath, contained in a porcelain tank :—

Potass. bichromate	$\frac{1}{4}$ oz.	12·5 gms.
Ammonium bromide	$\frac{1}{4}$ oz.	12·5 gms.
Water	20 ozs.	1,000 c.c.s

Wash for 30 minutes, wipe with a pad of cotton wool and stand aside—of course in the dark or by deep ruby light—to dry.

Backing Dry Plates.

Gum solution (ordinary office gum)	1 oz.	100 c.c.s.
Caramel	1 oz.	100 gms.
Burnt sienna, ground in wate	2 ozs.	200 gms.

Mix and add—

Alcohol	2 ozs (fl.)	200 c.c.s.

BACKING SHEETS FOR DRY PLATES.

Gelatine	1 part	50 gms.
Water	2 parts	100 c.c.s
Glycerine	1 part	50 c.c.s.
Indian ink	A small addition.	

Make a paste, and coat strong paper, place the prepared material face downwards on waxed glass to set. Press to back of plate before putting into dark slide.

The Dusting-on Process.

Best gum arabic	80 grs.	5·2 gms.
White sugar	60 grs.	4 0 gms.
Ammonium bichromate	60 grs.	4·0 gms.
Water	7 ozs.	200 c.c.s.
Methylated spirit	1 oz.	30 c.c.s.

This mixture will keep for a few days only, and after the plate has been coated and exposed it is developed with finest graphite powder, collodionised, and washed.

Ink for Rubber Stamps.

Aniline red (violet)	900 grs.	210 gms.
Boiling distilled water	10 oz.	1,000 c.c.s.
Glycerine .. .. .. about	½ oz	60 c.c.s.
Treacle .. .. .. about	¼ oz.	30 c.c.s.

Invisible Ink.

Chloride of cobalt..	25 grs.	60 gms.
Distilled water	1 oz. (fl.)	1,000 c c s.

Writing executed with this ink is first pink on paper, becoming invisible on drying. On warming the writing turns blue.

Dead Black for Wood.

Borax .. .	30 grs.	8 gms.
Glycerine .. .	30 minims	8 c.c.s.
Shellac	60 grs.	16 gms.
Water	8 ozs.	1,000 c.c.s

Boil till dissolved and add

Nigrosine, W.S.	60 grs.	16 gms.

Or paint the wood first with—

Cupric chloride	75 grs.	75 gms.
Potass bichromate	75 grs.	75 gms.
Water	2½ ozs.	1,000 c.c.s.

and as soon as the surface dries apply—

Aniline hydrochloride	150 grs.	150 gms.
Water	2½ ozs.	1,000 c.c.s.

and wipe off any yellow powder that forms. Repeat the process till black enough, and then rub over with boiled linseed oil.

Waterproofing Solution for Wood.

Asphalt	4 ozs.	400 gms.
Pure rubber	30 grs.	6 gms.
Mineral naphtha	10 ozs.	1,000 c.c.s.

Apply with a stiff brush and give three successive coats, allowing to dry between each The vapour from this solution is very inflammable.

Polish for Cameras, Woodwork, etc.

Linseed oil..	20 ozs.	400 c.c.s.
Spirits of camphor	2 ozs.	40 c.c.s.
Vinegar	4 ozs.	80 c.c.s.
Butter of antimony	1 oz,	20 gms
Liquid ammonia	¼ oz.	5 c.c.s.
Water	¼ oz.	5 c.c.s.

This mixture is applied very sparingly with a bit of old flannel and thoroughly rubbed off with soft rags.

Blackening Brass Work.

Copper nitrate	200 grs	450 gms.
Water	1 oz.	1,000 c.c.s.

Place the brass work (perfectly cleaned) in the solution for a few moments, heating it on removal.

Varnish for Brass Work.

Celluloid	10 grs.	4 gms.
Amyl alcohol	½ oz.	100 c.c.s.
Acetone	½ oz.	100 c.c.s.

Instead of this cold celluloid varnish, commercial "cold lacquer" can be used.

To Blacken Aluminium.

Clean the metal thoroughly with fine emery powder, wash well, and immerse in—

Ferrous sulphate	1 oz	80 gms.
White arsenic	1 oz.	80 gms.
Hydrochloric acid	12 ozs.	1,000 c.c.s.

Dissolve and add—

Water	12 ozs.	1,000 c.c.s.

When the colour is deep enough dry off with fine sawdust, and lacquer.

Silvering Mirrors (Martin's Method).

(*In employing the following formulæ, it should be well understood that the glass plate to be silvered must be scrupulously clean.*)

A.—Nitrate of silver	175 grs.	40 gms.
Distilled water .. .	10 ozs.	1,000 c.c s.
B.—Nitrate of ammonium . ..	262 grs.	60 gms.
Distilled water	10 ozs.	1,000 c.c.s.
C.—*Pure* caustic potash .. .	1 oz.	100 gms.
Distilled water	10 ozs.	1,000 c.c.s.
D.—Pure sugar candy .. .	½ oz. (avoir.)	100 gms.
Distilled water	5 ozs.	1,000 c.c.s.
Dissolve and add—		
Tartaric acid	50 grs.	23 gms.
Boil in flask for ten minutes, and when cool add—		
Alcohol	1 oz.	200 c.c.s.

Distilled water, *quant. suff.* to make up to 10 ozs. or 2,000 c.c.s.

For use take equal parts of A and B. Mix together also equal parts of C and D, and mix in another measure. Then mix both these mixtures together in the silvering vessel, and suspend the mirror face downwards in the solution.

MISCELLANEOUS INFORMATION.

List of the Principal Works on Photography.

[The books mentioned below are obtainable by order of all photographic dealers.]

Elementary and General Text-books.

Amateur Photography. By F. T. Beeson and A. Williams. 1s.

Elementary Photography By John A. Hodges. 1s.

Ilford Manual of Photography. By C. H. Bothamley. 1s.

Sinclair Handbook of Photography. 1s.

Barnet Book of Photography 1s. 6d.

A Primer of Photography. By Captain Owen Wheeler. 2s. 6d.

Early Work in Photography. By W. Ethelbert Henry. 1s.

Hand-Camera Photography. By Walter Kilbey. 1s.

Photography in a Nutshell. By the Kernel. 1s.

Photographic Reference Book. By J. McIntosh. 1s. 6d.

The Science and Practice of Photography. By Chapman Jones. 5s.

Instruction in Photography. By Sir William Abney. 11th Edition. Revised and enlarged. 7s. 6d.

Dictionary of Photography. By E J Wall. 7s. 6d.

Cyclopædia of Photography. Edited by Bernard E. Jones. 10s.

The Complete Photographer. By R. Child Bayley. 10s. 6d.

Photography. By Alfred Watkins. 6s.

Photography in Principle and Practice. By S. E. Bottomley. 3s. 6d.

Photography of To-day. By H. Chapman Jones. 5s.

Copyright and Press Photography.

Photographic Copyright. By George E. Brown, F.I.C., and Alexander Mackie. 1s.

Photographs for the Papers. By John Everard. 1s.

Photographic Optics and Chemistry.

Photographic Lenses: How to Choose and How to Use. By John A. Hodges. 2s.

Photographic Lenses. By Conrad Beck and Herbert Andrews. 1s.

The Lens. By Thos. Bolas and George E. Brown. 2s. 6d.

The Optics of Photography and Photographic Lenses. By J. Traill Taylor. 3s. 6d.

System of Applied Optics. By H. Dennis Taylor. 30s.

Photographic Optics, a Treatise on. By R. S. Cole. 6s.

Photographic Optics. By Otto Lummer. Translated by Silvanus Thompson. 6s.

First Book of the Lens. By C. Welborne Piper. 2s. 6d.

Telephotography. By T. R. Dallmeyer. 21s.

Modern Telephotography. By Captain Owen Wheeler. 1s. 6d.

Practical Telephotography. (No. 90 of "The Photo-Miniature.")

Lens work for Amateurs. By Henry Orford. 3s.

Tables of Conjugate Foci. By J. R. Gotz. 6d.

Chemistry for Photographers. By Charles F. Townsend, F.C.S. 1s.

The Chemistry of Photography. By R. Meldola. 6s.

Investigations on the Photographic Processes. By S. E. Sheppard, D.Sc., and C. E. Kenneth Mees, D.Sc. 6s. 6d.

Art, Portraiture, Hand-camera Work, Etc.

Art Principles in Portrait Photography. By C. W. Beck. 12s 6d.

Picture-making by Photography. By H. P. Robinson. 2s. 6d.

Photography on Tour. 6d.

Correct Exposure. (No. 105 of "The Photo-Miniature.")

Practical Landscape Photography. By G. T. Harris. 1s.

The Photographic Studio. A guide to its construction, etc. By T Bolas. 2s.

Lighting in Photographic Studios By P. C. Duchochois. Revised, with additional matter, by W. Ethelbert Henry, C.E 1s.

The Studio, and what to do in it. By H P. Robinson 2s. 6d.

Practical Professional Photography. Vols. I and II. By C H Hewitt. 1s. per vol.

Magnesium Light Photography. By F. J. Mortimer. 1s.

Hand-Cameras. By R. Child Bayley. 1s 6d.

Hand-Camera Work. (No. 107 of "The Photo-Miniature.")

Reflex Cameras. (No. 99 of "The Photo-Miniature.")

Photography of Moving Objects and Hand-camera Work for Advanced Workers. By Adolphe Abrahams 1s

Instantaneous Photography. By Sir William Abney. 1s.

Copying Methods. (No. 41 of "The Photo-Miniature.")

Panoramic Photography. (No. 73 of "The Photo-Miniature.")

Stereoscope and Stereoscopic Photography. From the French of F. Drouin. 2s.

Stereoscopic Photography. (No 98 of "The Photo-Miniature.")

Photo-micrography. By E. J. Spitta. 12s.

Handbook of Photo-micrography. By H. Lloyd Hind and W. Brough Randles. 7s 6d

NEGATIVE PROCESSES.

Wet-collodion Photography. By Charles W. Gamble. 1s.

The Wet Collodion Process. By Arthur Payne. 3s.

Collodion Emulsion. By H. O. Klein. 5s.

Practical Orthochromatic Photography. By Arthur Payne. 1s.

The Photography of Coloured Objects. By C. E. Kenneth Mees, D.Sc. 1s.

Negative-making. By Sir William Abney, F.R S. 1s

The Watkins' Manual (of exposure and development). By Alfred Watkins. 1s.

Photography by Rule. By J. Sterry. 1s.

Finishing the Negative Edited by H. Snowden Ward. 1s.

Retouching. By Arthur Whiting. 1s.

Art of Retouching. By J. Hubert. 1s.

Art of Retouching Negatives, and Finishing and Colouring Photographs. By T. S. Bruce and Alfred Braithwaite. 2s. 6d.

PRINTING PROCESSES.

Photographic and Photo-mechanical Printing Processes. By W. K. Burton. 4s.

Art and Practice of Silver Printing. By Sir William Abney and H. P. Robinson. 2s. 6d

Bromide Enlarging and Contact Printing. By S. Herbert Fry. 6d

Toning Bromide Prints. By R. Blake Smith. 1s.

Toning Bromides. By C. W. Somerville. 1s.

Toning Bromide and Gaslight Prints. (No. 103 of "The Photo-Miniature.")

Photographic Enlarging. By R. Child Bayley. 1s. 6d.

Photographic Enlargements: How to Make Them. By Geo. Wheeler. 1s.

A B C Guide to Autotype Permanent Photography. By J. R. Sawyer, 1s.

Carbon Printing. By E. J. Wall. 1s.

Photo-aquatint, or Gum Bichromate Process. By Alfred Maskell and R. Demachy. 1s.

Oil and Bromoil Printing. (No. 106 of "The Photo-Miniature.")

Platinotype Printing. By A. Horsley Hinton. 1s.

Ferric and Heliographic Processes. By George E. Brown. 2s.

Photographic Reproduction Processes. By P. C Duchochois. A treatise on photographic impressions without silver salts. 2s. 6d.

Photo-ceramics. By W. Ethelbert Henry, C.E., and H. Snowden Ward. 1s. 6d.

Trimming, Mounting, and Framing. (No. 102 of "The Photo-Miniature.")

LANTERNS AND LANTERN SLIDES: CINEMATOGRAPH.

Modern Magic Lanterns. By R. Child Bayley. 1*s.*

The Lantern, and How to Use It. By Goodwin Norton. 1*s.*

Optical Projection. By Lewis Wright. 6*s.*

The Optical Lantern: for Instruction and Amusement. By Andrew Pringle. 2*s.* 6*d.*

Practical Slide-making. By G. T. Harris. 1*s.*

Colouring Lantern Slides. (No 83 of "The Photo-Miniature.")

Living Pictures. By H. V. Hopwood. 2*s.* 6*d.*

Animated Photography By Cecil M. Hepworth 1*s.*

The Handbook of Kinematography. By Colin N. Bennett. 5*s.*

The Modern Bioscope Operator. 1*s.* 6*d.*

PHOTO-MECHANICAL PROCESSES, ETC.

Horgan's Half-tone and Photo-mechanical Processes. By S. H. Horgan. 12*s.* 6*d.*

Half-tone Process, The. By Julius Verfasser. 5*s*

Half-tone Process on the American Basis. By Wm. Cronenberg. 2*s.*

A Treatise on Photogravure in Intaglio By the Talbot Klic process. By Herbert Denison. 4*s.* 6*d.*

Photo-Mechanical Processes. By W. T. Wilkinson. 4*s.*

Photo-aquatint and Photogravure. By Thomas Huson 2*s.*

Practical Radiography. A handbook of the applications of the X-rays. By A. W. Isenthal and H. Snowden Ward. 6*s.*

COLOUR PHOTOGRAPHY.

Photography in Colours. By Dr. Lindsay Johnson. 3*s.* 6*d.*

Photography in Colours. By Bolas, Tallent and Senior. 1*s.* 6*d.*

Three-colour Photography. By Baron von Hubl. Translated by H. O. Klein. 7*s.* 6*d.*

Natural-colour Photography. By Dr. E. Konig. Translated by E. J. Wall. 2*s.*

COPYRIGHT IN PHOTOGRAPHS.

The law of the reproduction of photographs is now governed by the Copyright Act, 1911, which came into force in Great Britain and in some minor British Protectorates on July 1, 1912.

The Copyright (Works of Art) Act, 1862, given in previous editions of the "Almanac," is repealed with the exception of Sections 7 and 8.

The new Act provides protection for all classes of work, both literary and artistic, and is, therefore, a lengthy one, but the chief provisions as to photographs are given below. For a full and adequate, yet simple, treatment of the subject, as far as possible in non-legal language, the reader is referred to "Photographic Copyright," written by the Editor of this Almanac in conjunction with Alexander Mackie, hon. secretary of the Professional Photographers' Association, and published by Messrs. H. Greenwood and Co., Ltd., 24, Wellington Street, Strand, London, W.C., price 1s. net, post free, inland and abroad, 1s. 2d.

Copyright in a photograph lasts for fifty years from the making of the negative.

Registration of copyright is abolished.

The copyright belongs to the author unless first made "to the order" of some other person for a valuable consideration, in which case it belongs to the person giving the order

All assignments of copyright must be in writing.

Photographers can obtain civil remedies (damages, injunctions, etc.) for infringement of copyright; or, where infringement is shown to have been done knowingly, summary remedies (fines and imprisonment) against the infringer.

Infringing copies may be prevented from importation into the United Kingdom by notice to the Customs' Commissioners.

Existing copyright photographs (made before July 1, 1912) obtain the full protection of copyright granted by the 1911 Act. They obtain this whether registered or not under the old Act.

The Act provides for copyright in cinematograph films, and permits photographs to be taken of copyright architectural works of art (buildings); and also of sculpture which is situated in a public place. Such photographing is not an infringement of the copyright in the architecture or sculpture.

In accordance with certain unrepealed clauses of the Copyright Act of 1862 it is an offence against the photographer for his work to be fraudulently issued with a false name or marking, or to be exhibited or sold falsely marked. Copies of photographs may not be issued as having been made by the original author, and a photograph in which unauthorised alterations have been made must not be issued as the unaltered work of the author.

REPRODUCTION FEES.

The Copyright Union has drawn attention to the following suggestions, drawn up for the guidance of its members, by Mr. Alfred Ellis:—

Members are advised not to give permission for their copyright photographs to be reproduced until they have full particulars of the size and style of the proposed reproduction, when they can formulate their charges accordingly. For example: a newspaper should pay a fee of not less than 10s. 6d. for half-tone black-and-white reproduction not exceeding 6 by 4 ins., when printed with letterpress in one issue of a newspaper; but if it is to be printed as an inset the fee should be at least one guinea. If printed in colours, collotype, or photogravure, it should be a still higher fee. If a photograph is to be reproduced for advertising purposes a higher fee should be charged than for newspaper work. In all cases the permission must be in writing, and should state the fee to be paid, the process by which the photograph is to be reproduced, and whether in black-and-white or colours, the size limit, and the purpose for which the reproduction may be used.

TABLES.

WEIGHTS AND MEASURES.

The formulæ in the editorial pages of this ALMANAC are given, in almost all cases, in both British and metric measures, and in adopting this course we have had the desire to impress upon photographers the simplicity and facility of the latter system. As a rule, the British formulæ are expressed in grains or ounces per 20 ozs. of solution, and the metric formulæ in grammes per 1000 c.c.s. In regard to the total bulk of solution, our formulæ are mostly drawn up on the basis that the total bulk after the solution of the solids is that stated in the formula—20 ozs. or 1000 c.c.s. as a rule.

The question of a 10 per cent. solution is a point in formulæ making and using which has caused endless discussion; but it is really simple enough if it be borne in mind that the ounce avoirdupois contains 437½ grains, while the fluid ounce contains 480 minims. As 10 per cent. solutions, being strong, are usually measured out in minims, the ounce avoirdupois must be dissolved in enough water to make a solution containing 1 grain in 10 minims; that is to say, 4375 minims, or practically 9 ounces, is the proper bulk for the solution of 1 ounce avoirdupois. But if a solution is to be measured out in fluid ounces, then the 10 per cent. solution will be 1 oz. in 10 fluid ozs.

Throughout this work "grains per ounce" are converted into "grammes per litre" by multiplying by 2·3. Ounces per any given number of fluid ounces are converted by taking the same ratio of grammes to 1000 c.c.s.

In reference to the names of chemicals, "sodium carbonate" and "sodium sulphite" are used for the crystallised forms of these substances. If the "dry" ("anhydrous") forms are meant, one or other of these terms is used in qualification.

British Weights and Measures.

1. APOTHECARIES WEIGHT.*

20 Grains = 1 Scruple.
3 Scruples = 1 Drachm = 60 Grains.
8 Drachms = 1 Ounce = 480 Grains.

2. AVOIRDUPOIS WEIGHT.*

437½ Grains = 1 Ounce.
16 Ounces = 1 Pound = 7000 Grains.
¼ ounce = 109 grains, ½ ounce = 219 grains; ¾ ounce = 328 grains.

3. FLUID MEASURE.

60 Minims = 1 Drachm.
8 Drachms = 1 Ounce = 480 Minims.
20 Ounces = 1 Pint = 160 Drachms = 9600 Minims.
2 Pints = 1 Quart = 40 Ounces = 320 Drachms.
4 Quarts = 1 Gallon = 160 Ounces = 1280 Drachms.

1 fluid ounce of water weighs 437½ grains, therefore every minim weighs 0·91 grains.

Metric Weights and Measures.

The unit of weight is the gramme, written "gm."; the subdivisions are the "deci-" (1/10th), "centi-" (1/100th), and "milligramme" (1/1000th); the multiples are the "deka-" (10 gm.) and "hectogramme" (100 gm.), but in practice it is usual to use the terms 0·1 or 0·01 and 10 or 100 grammes, and the abbreviation "kilo." for 1000 gms.

The following are the equivalents of Metric Weights and Measures in terms of Imperial Weights and Measures.—

LINEAR MEASURE.

1 Millimetre (mm.) (1/1000th M.)	=	0·03937 inch
1 Centimetre (1/100th M.) .	=	0·3937 ,,
1 Metre (M.)	=	39·370113 inches 3·280843 feet 1·0936143 yards
Kilometre (1000 M.)	=	0·62137 mile

SQUARE MEASURE

1 Square Centimetre	=	0·155 square inch
1 Square Metre (100 square decimetres)	=	10·7639 square feet 1·196 square yards

WEIGHT.		*Avoirdupois.*
1 Milligramme (1/1000th gm.) ..	=	0·015 grain
1 Gramme (1 gm.)	=	15·432 ,,
1 Kilogramme (1000 gm.) ..	=	2·2046223 lbs. or 35·273957 ozs.

* It is now customary in formulæ to employ the avoirdupois ounce (437½ grains), but in cases where "drachms" are given the apothecaries' drachm of 60 grains is taken as the unit.

FLUID MEASURE.

1 Cubic centimetre* (c.c.) (1/1000th litre) = 16·9 minims
1 Litre (1 L.) = 35 ozs. 94 m. = 16894·1 minims

Conversion of Metric into British Measures.

GMS. PER LITRE INTO GRAINS PER 10* OZS.

The following table gives the most convenient means of translating metric formulæ into British measures.

* The figures given in Columns 2, 4, and 6 are a correct translation of the metric proportion when the solution is measured out in ounces and fractions of an ounce. If to be measured in minims, the quantities in Columns 2, 4, and 6 are dissolved in 9 ozs. 2 drs. of water.

1 Gms Per Litre	2 Grs. Per 10† ozs.	3 Gms. Per Litre.	4 Grs. Per 10† ozs.	4 Ozs. Grs. Per 10† ozs.	5 Gms. Per Litre.	6 Grs. Per 10† ozs.	6 Ozs Grs Per 10† ozs.
1	4·4	30	131	¼—22	155	678	1½—22
2	8·8	35	153	¼—44	160	700	1½—44
3	13·1	40	175	¼—66	165	722	1½—66
4	17·5	45	197	¼—88	170	744	1½—88
5	21·9	50	219	½—0	175	766	1¾—0
6	26·2	55	241	½—22	180	788	1¾—22
7	30·6	60	262	½—43	185	809	1¾—43
8	35 0	65	284	½—65	190	831	1¾—65
9	39·4	70	306	½—87	195	853	1¾—87
10	43·8	75	328	¾—0	200	875	2
11	48·1	80	350	¾—22	225	984	2¼
12	52·5	85	371	¾—43	250	1,094	2½
13	56·9	90	393	¾—65	275	1,203	2¾
14	61·2	95	415	¾—87	300	1,313	3
15	65·6	100	437	1—0	325	1,422	3¼
16	70·0	105	459	1—22	350	1,531	3½
17	74·4	110	481	1—44	375	1,641	3¾
18	78·8	115	503	1—66	400	1,750	4
19	83·1	120	525	1—88	425	1,859	4¼
20	87·5	125	547	1¼—0	450	1,969	4½
21	91·9	130	569	1¼—22	475	2,078	4¾
22	96·2	135	591	1¼—44	500	2,187	5
23	100·6	140	613	1¼—66			
24	105·0	145	634	1¼—87			
25	109·4	150	656	1½—0			

† *N.B.*—Quantities in Columns 2, 4, and 6 are dissolved in 9 ozs. 2 drs. when solutions are to be measured out in minims.

* *Millilitre and C C.*—Revisions of metric standards have shown that the litre is not exactly 1000 c.c.s., but 999·84 c.c.s. (according to Mendeeleef's calculations from the experimental data). The difference appears sufficiently serious in official circles to warrant the abandonment of the term "cubic centimetre," and the employment of "millilitre" for the true thousandth part, millilitre to be abbreviated to "mil." On grounds of terminology there is some reason for this, but until "millilitre" commences to oust c.c. from current writings we shall continue to use the latter term. As regards error, the difference is absolutely negligible, not more than 4 drops in 35 ozs.

GRAMMES INTO GRAINS AND OUNCES (AVOIRDUPOIS).

Gms	Ozs.	Grs.	Gms.	Ozs.	Grs.	Gms.	Ozs.	Grs.
0·1		1·5	16	½	28 1	130	4½	37
0·2		3·1	17	½	43·5	140	4¾	82
0·3		4 6	18	½	59·0	150	5¼	18
0·4		6·2	19	½	74 4	160	5½	61
0·5		7·7	20	½	89·8	170	6	0
0 6		9·1	25	¾	57·0	175	6	76
0·7		10·8	30	1	25	180	6¼	44
0·8		12 4	35	1	103	190	6½	88
0·9		13·9	40	1¼	71	200	7	24
1		15·4	45	1½	38	250	8¾	32
2		30·9	50	1¾	6	300	10½	31
3		46·3	55	1¾	83	350	12¼	41
4		61·7	60	2	51	400	14	50
5		77·2	65	2¼	19	450	15¾	52
6		92 6	70	2¼	94	500	17½	61
7		108 0	75	2½	64	550	19¼	66
8	¼	14 1	80	2¾	32	600	21	70
9	¼	29 5	85	3	0	650	22¾	72
10	¼	44 9	90	3	76	700	24½	81
11	¼	60·4	95	3¼	44	750	26¼	91
12	¼	75·8	100	3½	11	800	28	95
13	¼	91·2	110	3¾	56	850	29¾	102
14	¼	106 7	120	4	102	900	31½	106
15	½	12 7	125	4¼	70	1000	35¼	11

Note.—In the above table the British equivalents are given in the form most convenient for actual work, viz, in even ounces and quarter ounces, with odd grains over. If calculations need to be made, the following figures giving the equivalents of ounces and quarter-ounces in grains will be found useful :—

¼ oz. = 109 grs.	1¾ oz. = 765 grs.	3¼ ozs. = 1,421 grs.	4¾ ozs. = 2,078 grs.
½ oz. = 219 grs.	2 ozs. = 875 grs	3½ ozs. = 1,531 grs.	5¼ ozs. = 2,296 grs.
¾ oz. = 328 grs.	2¼ ozs. = 984 grs.	3¾ ozs. = 1,640 grs.	5½ ozs. = 2,406 grs.
1 oz. = 437 grs.	2½ ozs. = 1,094 grs.	4 ozs. = 1,750 grs.	6 ozs. = 2,625 grs.
1¼ oz. = 546 grs.	2¾ ozs. = 1,203 grs	4¼ ozs. = 1,859 grs.	6¼ ozs. = 2,734 grs.
1½ oz. = 656 grs.	3 ozs. = 1,312 grs.	4½ ozs. = 1,969 grs.	6½ ozs. = 2,844 grs.

C.C.S. INTO MINIMS AND OUNCES (FLUID).

C.c.s.	Ozs.	Mins.	C.c.s.	Ozs.	Mins.	C.c.s.	Ozs.	Mins.
1		16·9	6		101·4	11	¼	66
2		33·8	7		118·3	12	¼	83
3		50·7	8	¼	15·2	13	¼	100
4		67·6	9	¼	32	14	¼	117
5		84·5	10	¼	49	15	½	13

C.C.S. INTO MINIMS AND OUNCES (FLUID).—*Continued.*

C c s.	Ozs.	Mins.	C.c.s.	Ozs	Mins.	C c.s	Ozs.	Mins
16	½	30	120	4	107	500	17½	47
17	½	47	125	4¼	72	525	18¼	110
18	½	64	130	4½	36	550	19¼	52
19	½	81	140	4¾	85	575	20	114
20	½	98	150	5¼	14	600	21	56
25	¾	82	160	5½	63	625	22	0
30	1	27	170	5¾	112	650	22¾	61
35	1	111	175	6	76	675	23¾	4
40	1¼	76	180	6¼	41	700	24½	66
45	1½	40	190	6½	90	725	25½	8
50	1¾	5	200	7	20	750	26¼	70
55	1¾	89	225	7¾	81	775	27¼	13
60	2	54	250	8¾	24	800	28	75
65	2¼	18	275	9½	86	825	29	18
70	2¼	103	300	10½	28	850	29¾	80
75	2½	67	325	11¼	90	875	30¾	22
80	2¾	32	350	12¼	33	900	31½	65
85	2¾	116	375	13	95	925	32½	27
90	3	81	400	14	37	950	33¼	90
95	3¼	45	425	14¾	100	975	34¼	32
100	3½	10	450	15¾	42	1000	35	94
110	3¾	58	475	16½	105			

Conversion of British into Metric Measures.

GRAINS INTO GRAMMES.

Grs.	Gms.	Grs.	Gms.	Grs.	Gms.
1	0·065	16	1·037	35	2·268
2	0·13	17	1·102	40	2·592
3	0·194	18	1·166	45	2·916
4	0·259	19	1·232	50	3·240
5	0·324	20	1·296	55	3·564
6	0·389	21	1·361	60	3·888
7	0·454	22	1·426	65	4·212
8	0·518	23	1·490	70	4·536
9	0·583	24	1·555	75	4·860
10	0·648	25	1·620	80	5·184
11	0·713	26	1·685	85	5·508
12	0·775	27	1·750	90	5·832
13	0·842	28	1·814	95	6·156
14	0·907	29	1·880	100	6·480
15	0·972	30	1·944		

OUNCES (AVOIRDUPOIS) TO GRAMMES.

Ozs.	Gms.	Ozs.	Gms.	Ozs.	Gms.
¼	7·09	4	113·40	13	368·54
½	14 17	5	141·75	14	396·89
¾	21·26	6	170·10	15	425·24
1	28·35	7	198·45	16	453 59
1½	42 5	8	226·80	17	481·94
2	56·70	9	255·15	18	510·29
2½	70 87	11	311·8	19	538 64
3	85 05	12	340 19	20	566·99

FLUID OUNCES AND DRACHMS TO C.C S.

Minims.		C.c.s.	Drs.	C.c.s.	Ozs.	C.c.s.	Ozs.	C.c.s.
5	=	·3	½	1·78	1½	42·6	11	312·5
10	=	·6	1	3 55	2	56 8	12	341·0
15	=	·9	2	7 10	3	85 2	13	369 3
20	=	1·2	3	10·65	4	113 6	14	398 0
25	=	1·4	4	14 20	5	142 0	15	426 0
			5	17 75	6	170 5	16	454·5
			6	21·30	7	198 9	17	483·0
			7	24·86	8	227·3	18	511·5
			8	28·41	9	255·7	19	540·0
					10	284·0	20	568·0

CONVERSION RULES

Grammes per litre into grains per ounce.—Multiply the grammes by 0·44.

C.c.s. per litre into minims per ounce.—Divide the c.c.s. by 2 (more exactly, multiply by 0·48).

Grains per ounce into grammes per litre.—Multiply the grains by 2·3. Thus 50 grs. per oz. = 115 gms. per litre.

Minims per ounce into c.c.s. per litre.—Multiply the minims by 2.

COINS AS WEIGHTS.

Silver coinage, it is useful to note, is minted exactly by weight in proportion to its value, viz., 436 4/11 grains for every 5s. Thus the threepenny bit is 21·8 grs.; a sixpence, 43·6; shilling, 87·2; florin, 175 4; half-crown, 218 grs.

Thus the sixpence and threepenny piece are almost exactly one-tenth and one-twentieth of the avoirdupois ounce.

Bronze coinage—Three pennies, or five halfpennies, or ten farthings = 1 oz. (avoirdupois).

i.e, the penny = 145·8 grs.; 1 halfpenny, 87·5; and 1 farthing, 43·75 grs.

One sovereign weighs 123·27 grs.; the half-sovereign, 61·63 grs.

¼ oz.	(avoir.)	=	one-halfpenny and one threepenny piece.
½ „	„	=	two halfpennies and a farthing.
1 „	„	=	three pennies (or five halfpennies).
2 „	„	=	six pennies (or ten halfpennies).
4 „	„	=	twelve pennies (or twenty halfpennies).

FRENCH COINS AS METRIC WEIGHTS.

Lord Crawford's table.

	Silver Coins.		*Bronze Coins.*
25 gms... ..	5 francs	10 gms. ..	10 centimes
10 „	2 „	5 „ ..	5 „
5 „	1 „	2 „ ..	2 „
2½ „	½ „ or 50 centimes	1 „ ..	1 „

PARTS.

Formulæ given, as many are, in "parts," may be made up by writing gms. for the solid and c.c.s. for the fluid "parts," and converting them into the British measures by any of the tables in this section. Thus: Adurol, 10 parts; sodium sulphite, 100 parts; water 1000 parts becomes adurol, 154 grs.; sodium sulphite, 3 ozs. 230 grs.; water, 35 ozs.

INCHES INTO MILLIMETRES. MILLIMETRES INTO INCHES.

Inches.	Millimetres.	Inches.	Millimetres.	Millimetres.	Inches.	Millimetres.	Inches.
1	25·4	3/8	9·5	0 1	0·0039	13	0·51
15/16	23·8	11/32	8·7	0·5	0·015	14	0·55
9/10	23·0	5/16	7·9	1	0·04	15	0·59
7/8	22·2	9/32	7·1	2	0 08	16	0·63
				3	0·12	17	0 67
13/16	20·6	1/4	6·4	4	0·16	18	0·71
3/4	19·1	7/32	5 6	5	0 20	19	0·75
11/16	17·5	3/16	4 8	6	0 24	20	0·79
				7	0 28	21	0·83
5/8	15·9	1/8	3·2	8	0·31	22	0·87
9/16	14·3	3/32	2 4	9	0 35	23	0 90
1/2	12·7	1/16	1·6	10	0 39	24	0·94
7/16	11·1	1/32	0 8	11	0 43	25	0 98
				12	0·47	25·4	1·0

ENGLISH SIZES OF PLATES.

Inches.	Cm.	Inches.	Cm.
3¼ × 2½	8 3 × 6·4	7 × 5[5]	17·8 × 12·7
3¼ × 3¼[1]	8 25 × 8·25	8½ × 6½[6]	21·5 × 16·5
4¼ × 3¼[2]	10 8 × 8 25	10 × 8	25·4 × 20·3
5 × 4[3]	12 7 × 10·1	12 × 10	30·4 × 25·4
6½ × 4¾[4]	16·5 × 12·0	15 × 12	38·1 × 30 4

[1] Lantern plate. [2] Quarter-plate. [3] Smallest common size in America [4] Half-plate. [5] Usual medium size in America. [6] Whole-plate.

CONTINENTAL SIZES OF PLATES IN COMMON USE.

Cm.	Inches	Cm	Inches.
4·5 × 6 0*	1¾ × 2⅜	13 × 21	5 12 × 8 25
9 × 12†	3 54 × 4 72	18 × 24	7 08 × 9·44
12 × 16	4·72 × 6 30	24 × 30	9·44 × 11·81
13 × 18‡	5·12 × 7 08	30 × 40	11·81 × 15·75

* Standard size of vest pocket plate camera.
† The standard small size, equivalent to the British quarter-plate.
‡ The standard medium size (British half-plate).

Foreign Lantern Slides.

The standard French size for lantern slides is 10 by 8 cm., though many makers prepare slides 3¼ by 3¼. The American size is 4 by 3¼, though some makers use the English quarter-plate (4¼ by 3¼).

CHEMICAL TABLES.

TABLE OF SYMBOLS AND EQUIVALENT WEIGHTS OF THE MORE IMPORTANT COMPOUNDS USED IN PHOTOGRAPHY.

The atomic weights of the elements employed in working out the equivalent weights given below are the round numbers contained in the first column of the Table of Atomic Weights on page 705.

NAME.	SYMBOL.	EQUIV. WEIGHT
Acetone	C_3H_6O	58
,, sulphite	$C_3H_6OH\,SO_3Na$	162
Acid, acetic	$C_2H_4O_2$	60
,, benzoic	C_6H_5COOH	122
,, boric	H_3BO_3	62
,, carbolic	C_6H_5OH	94
,, chlorochromic	$Cl\,Cr\,O_2\,OH$.	136·5
,, chromic (anhydride).	$Cr\,O_3$	100
,, citric	$C_6H_8O_7\,H_2O$	210
,, dithionic	$H_2S_2O_6$	162
,, formic	H_2CO_2	46
,, gallic	$C_6H_2(OH)_3\,COOH, H_2O$	188
,, hydrobromic	$H\,Br$	81
,, hydrochloric	$H\,Cl$	36·5
,, hydrofluoric	$H\,F$	34
,, lactic	$CH_3\,CH\,(OH)\,COOH$	90
,, nitric	HNO_3	63
,, oxalic	$H_2C_2O_4$	126
,, pentathionic	$H_2S_5O_6$	258
,, perchromic	$H\,Cr\,O_4$	117
,, phosphoric	H_3PO_4	98
,, picric	$C_6H_2(NO_2)_3OH$	139
,, pyrogallic	$C_6H_3(OH)_3$	126
,, salicylic	$C_6H_4(OH)\,COOH$	138
,, sulphuric	H_2SO_4	98
,, sulphurous	H_2SO_3	82
,, tannic	$C_{14}H_{10}O_9$	322
,, tartaric	$C_2H_2(OH)_2(COOH)_2$	150
,, tetrathionic	$H_2S_4O_6$	225
,, trithionic	$H_2S_3O_6$	194
Adurol*	$C_6H_3(OH)_2\,Cl$ (or Br)	—
Alcohol (methyl)	CH_3OH	32
,, (ethyl)	C_2H_5OH	46

* Adurol is mono-chlor (or mono-brom) hydroquinone.

TABLES OF SYMBOLS, &c.—Continued.

Name.	Symbol.	Equiv. Weight.
Alum, ammonia	$Al_2 (NH_4)_2 (SO_4)_4 24H_2O$	906
,, chrome	$Cr_2 K_2 (SO_4)_4 24H_2O$	998
,, iron ammonia	$Fe_2 (NH_4)_2 (SO_4)_4 24H_2O$	964
,, potash	$Al_2 K_2 (SO_4)_4 24H_2O$	948
Aluminium chloride	$Al_2 Cl_6 12H_2O$	267
,, sulphate	$Al_2 (SO_4)_3 16H_2O$	634
,, sulphocyanide	$Al_2 (CNS)_6$	402
Amidol	$C_6 H_3 OH (NH_2)_2 2HCl$	197
Ammonia	NH_3	17
Ammonium bichromate	$(NH_4)_2 Cr_2 O_7$	252
,, bromide	$NH_4 Br$	98
,, carbonate	$NH_4 HCO_3 + NH_2 COOH NH_4$	—
,, chloride	$NH_4 Cl$	53·5
,, chromate	$(NH_4)_2 Cr O_4$	152
,, citrate	$(NH_4)_2 C_6 H_6 O_7$	226
,, iodide	$NH_4 I$	145
,, molybdate	$(NH_4)_6 Mo_7 O_{24} 4H_2O$	1236
,, nitrate	$NH_4 NO_3$	80
,, oxalate	$(NH_4)_2 C_2O_4 H_2O$	142
,, persulphate	$(NH_4)_2 S_2 O_8$	228
,, phosphate	$(NH_4)_2 HPO_4$	132
,, sulphate	$(NH_4)_2 SO_4$	132
,, sulphide	$NH_4 HS$	51
,, sulphocyanide	$NH_4 CNS$	76
,, vanadate	$NH_4 VO_3$	117
Amyl, acetate	$C_7 H_{14} O_2$	130
,, alcohol	$(CH_3)_2 CH CH_2 CH_2OH$	88
Aniline	$C_6 H_5 NH_2$	93
Antimony, sulphide	$Sb_2 S_3$	336
Aurantia	$(C_6H_2(NO_2)_3)_2 N NH_4$	456
Aurine	$C (C_6 H_4 OH)_2 C_6 H_4 O$	290
Barium, bromide	$Ba Br_2 2H_2O$	333
chloride	$Ba Cl_2 2H_2O$	244
iodide	$Ba I_2$	391
nitrate	$Ba (NO_3)_2$	261
peroxide	BaO_2	201
sulphate	$Ba SO_4$	233
Benzole (benzene)	$C_6 H_6$	78
Borax (*see* Sodium borate).		
Bromine	Br	80
Cadmium, bromide	$Cd Br_2 4H_2O$	344
,, chloride	$Cd Cl_2$	183
,, iodide	$Cd I_2$	366
Calcium, carbide	$Ca C_2$	64
,, carbonate	$Ca CO_3$	100
,, chloride (cryst.)	$Ca Cl_2 6H_2O$	219

TABLE OF SYMBOLS, &c.—Continued.

Name.	Symbol.	Equiv. Weight.
Calcium, chloride (fused)	$Ca\,Cl_2$	111
„ hypochlorite	$Ca\,(O\,Cl)_2$	153
„ sulphate	$Ca\,SO_4\,2H_2O$	172
„ hydroxide (slaked lime)	$Ca\,(OH)_2$	74
Carbon, bisulphide	$C\,S_2$	76
Celloidin	$C_{12}\,H_{16}\,O_6\,(NO_3)_4$	504
Ceric, sulphate	$Ce\,(SO_4)_2\,4H_2O$	404
Chloral hydrate	$C\,Cl_3\,CH\,(OH)_2$	165·5
Chloroform	$CH\,Cl_3$	119·5
Chrysoidine	$C_6\,H_5\,N_2\,C_6\,H_3\,(NH_2)_2$	211·7
Cobalt, chloride	$Co\,Cl_2\,6H_2O$	238
Copper, bromide	$Cu\,Br_2$	223·5
„ chloride	$Cu\,Cl_2\,2H_2O$	170·5
„ nitrate	$Cu\,(NO_3)_2\,6H_2O$	357·5
„ sulphate	$Cu\,SO_4\,5H_2O$	249·5
Cyanine	$C_{29}\,H_{35}\,N_2\,I$	544
Dextrine	$(C_6\,H_{10}\,O_5)\,x$	—
Diamidophenol	$C_6\,H_3\,OH\,(NH_2)_2$	124
Edinol*		
Eikonogen†	$C_{10}\,H_5\,(OH)\,NH_2\,SO_2\,O\,Na$	263
Eosine	Na or K Salt of $C_6H_4(CO)_2O(C_6H\,OH\,X‡)_2$	—
Erythrosine	$C_6\,H_4\,(CO)_2\;O\;(C_6\;H\;OH\;X_2‡)_2$	—
Ether	$C_4\,H_{10}\,O$	74
Ferrous and ferric salts (See Iron)		
Formaline	40 % sol. of CH_2O	—
Glycerine	$C_3\,H_5\,(OH)_3$	92
Glycin§	$C_6\,H_4\,OH\,NHCH_2\,COOH$	167
Gold, chloride yellow	$H\,Au\,Cl_4\,4H_2O$	412
„ „ brown	$H\,Au\,Cl_4$	340
„ „ potassium	$K\,Au\,Cl_4\,2H_2O$	414
„ „ sodium	$Na\,Au\,Cl_4\,2H_2O$	398
Hydrogen, peroxide	H_2O_2	34
Hydroquinone	$C_6\,H_4\,(OH)_2$	110
Iodine	I	127
Iridious chloride	$Ir\,Cl_3$	299·5
„ tetrachloride	$Ir\,Cl_4$	335
„ potassium „	$K_2\,Ir\,Cl_6$	484
„ sodium „	$Na_2\,Ir\,Cl_6$	452
Iron.		
Ferric chloride (dry)	$Fe_2\,Cl_6$	325

* Edinol is the hydrochloride of γ-amido-oxy-benzyl-alcohol.

† Eikonogen is the sodium salt of amido- β-naphthol- β-monosulphuric acid.

‡ The X in these formulæ may be bromine, iodine, or chlorine, which elements in other proportions constitute the various commercial dyes.

§ Glycin is γ-oxyphenyl-glycin or γ-oxyphenyl-amido-acetic acid.

TABLES OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL	EQUIV. WEIGHT.
Ferric chloride (lump)	$Fe_2\,Cl_6\,12H_2O$	541
,, ammonia citrate, brown	$4\ Fe\ C_6\ H_5\ O_7\ \ 3(NH_4)_3\ C_6H_5O_7\ \ 3Fe\ (OH)_3$	2030
,, ,, ,, green	$5\,Fe\,C_6H_5O_7\,2(NH_4)_3\,C_6H_5O_7\ NH_4C_6H_7O_7\,2H_2O$	1956
,, oxalate	$Fe_2\,(C_2\,O_4)_3$	376
,, ammonium oxalate	$(NH_4)_3\,Fe\,(C_2\,O_4)_3 3H_2O$	428
,, potassium ,,	$K_3\,Fe\,(C_2\,O_4)_3\,3H_2O$	491
,, sodium ,,	$Na_6\,Fe\,(C_2O_4)_6\,11H_2O$	976
Ferrous, chloride (dry)	$Fe\,Cl_2$	127
,, ,, (cryst.)	$Fe\,Cl_2\,4H_2O$	199
,, oxalate	$Fe\,C_2\,O_4\,2H_2O$	180
,, potassium oxalate	$K_2\,Fe\,(C_2\,O_4)_2H_2O$	328
,, sulphate	$Fe\,SO_4\,7H_2O$	278
,, ammonia sulphate	$Fe\,(NH_4)_2\,(SO_4)_2\,6H_2O$	392
Lead, acetate	$Pb\,(C_2\,H_3\,O_2)_2\,3H_2O$	379
,, nitrate	$Pb\,(NO_3)_2$	331
Lithia, caustic	$Li\,OH$	24
Lithium, bromide	$Li\,Br$	87
,, carbonate	$Li_2\,CO_3$	74
Lithium, chloride	$Li\,Cl$ (cryst. has $2H_2O$)	42·5
,, iodide	$Li\,I$	134
Magnesium, chloride	$Mg\,Cl_2$	95
,, sulphate	$Mg\,SO_4\,7H_2O$	246
Manganese, peroxide	$Mn\,O_2$	87
,, sulphate	$Mn\,SO_4\,4H_2O$	225
Mercury	Hg	200
,, bichloride	$Hg\,Cl_2$	271
,, iodide	$Hg\,I_2$	454
,, potass. iodide (soluble)	$HgI_2{\cdot}2KI$	786
Metol*	$(C_6H_4OH\ NHCH_3p)_2\ H_2SO_4$	344
Ortol†	$(C_6H_4OH\,NHCH_3p) + C_6H_4\,(OH)_2p$	234
Palladious chloride	$Pd\,Cl_2$	177
,, potassium chloride	$K_2\,Pd\,Cl_4$	326
Para-amidophenol	$C_6\,H_4\,NH_2\,OH$	109
Phenol (see Acid carbolic)		
Platinum per (or bi)chloride	$H_2\,Pt\,Cl_6\,6H_2O$	516·4
Potassium, ammonium chromate	$K\,NH_4\,Cr\,O_4$	173
,, bicarbonate	$K\,H\,CO_3$	100
,, bichromate	$K_2\,Cr_2O_7$	294
,, boro-tartrate	$C_2\,H_2\,(OH)_2\,(CO_2)_2\,BOK$	214
,, bromide	$K\,Br$	119
,, carbonate (dry)	$K_2\,CO_3$	138

* Metol is the sulphate of mono-methyl-para-amido phenol.

† Ortol is a mixture of one molecule each of methyl-ortho-amido-phenol and hydroquinone.

TABLES OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL.	EQUIV. WEIGHT.
Potassium chlorate	$K\,Cl\,O_3$	122·5
,, chloride	$K\,Cl$	74·5
,, chloro-platinate	$K_2Pt\,Cl_4$	413·4
,, chromate	$K_2\,Cr\,O_4$	194
,, citrate	$K_3\,C_6\,H_5\,O_7\,H_2O$	342
,, cyanide	$K\,C\,N$	65
,, ferricyanide	$K_3\,Fe\,(CN)_6$	329
,, ferrocyanide	$K_4\,Fe\,(CN)_6\,3H_2O$	422
,, hydrate	$K\,HO$	56
,, iodide	$K\,I$	166
,, metabisulphite	$K_2\,S_2\,O_5$	222
,, nitrate	$K\,NO_3$	101
,, nitrite	$K\,NO_2$	85
,, oxalate	$K_2\,C_2\,O_4\,H_2O$	184
,, percarbonate	$K_2\,C_2\,O_6$	198
,, perchlorate	$K\,Cl\,O_4$	138·5
,, permanganate	$K_2\,Mn_2O_8$	316
,, persulphate	$K_2\,S_2\,O_8$	270
,, sulphate	K_2SO_4	174
,, sulphocyanide	$K\,C\,N\,S$	97
Pyrocatechin	$C_6\,H_4\,(OH)_2$	110
Rochelle salt	$K\,Na\,C_4\,H_4\,O_6\,4H_2O$	282
Schlippe's salt (sodium sulphantimoniate)	$Na_3\,Sb\,S_4\,9H_2O$	479
Silver, acetate	$Ag\,C_2\,H_3\,O_2$	167
,, ammonium nitrate	$Ag\,NO_3+2NH_3$	204
,, bromide	$Ag\,Br$	188
,, carbonate	$Ag_2\,CO_3$	276
,, chloride	$Ag\,Cl$	143·5
,, citrate	$Ag\,C_6\,H_5\,O_7$	513
,, fluoride	$Ag\,F\,4H_2O$	199
,, iodide	$Ag\,I$	235
,, nitrate	$Ag\,NO_3$	170
,, nitrite	$Ag\,NO_2$	154
,, oxalate	$Ag_2\,C_2\,O_4$	304
,, oxide	$Ag_2\,O$	224
,, phosphate	$Ag_3\,PO_4$	419
,, sulphate	$Ag_2\,SO_4$	312
,, sulphide	$Ag_2\,S$	248
,, tartrate	$Ag_2\,C_4\,H_4\,O_6$	363·4
Sodium, acetate	$Na\,C_2\,H_3\,O_2\,3H_2O$	136
,, ,, (fused)	$Na\,C_2\,H_3\,O_2$	102
,, bicarbonate	$Na\,H\,CO_3$	84
,, bichromate	$Na_2\,Cr_2\,O_7\,2H_2O$	298
,, bisulphite	$Na\,H\,SO_3$	104

TABLES OF SYMBOLS, &c.—Continued

Name.	Symbol.	Equiv. Weight
Sodium, borate	$Na_2 B_4 O_7 10H_2O$	382
„ bromide	$Na Br 2H_2O$	139
„ carbonate (dry)	$Na_2 CO_3$	106
„ carbonate (cryst.)	$Na_2 CO_3 10H_2O$	286
„ chloride	$Na Cl$	58·5
„ chloro-platinate	$Na_2 Pt Cl_6 6H_2O$	560·4
„ citrate	$Na_3 C_6 H_5 O_7 5\frac{1}{2}H_2O$	357
fluoride	$Na F$	42
hydrate (caustic)	$Na OH$	40
hydrosulphite*	$Na H SO_2$	88
hyposulphite†	$Na_2 S_2 O_3 5H_2O$	248
iodide	$Na I$	150
nitrate	$Na NO_3$	85
nitro-prusside	$Na_4 Fe_2 (CN)_{10} (NO)_2 4H_2O$.	600
oxalate	$Na_2 C_2 O_4$	134
phosphate	$Na_2HPO_4 12H_2O$	358
tribasic phosphate	$Na_3PO_4 12H_2O$	380
sulphate (cryst.)	$Na_2 SO_4 \cdot 10H_2O$	322
„ sulphide	$Na_2 S 9H_2O$	240
„ sulphite (dry)	$Na_2 SO_3$	126
„ „ (cryst.)	$Na_2 SO_3 7H_2O$	252
„ tungstate	$Na_{10} W_{12} O_{41} 28H_2O$	3598
Strontium, bromide	$Sr Br_2$	247·5
„ chloride (dry)	$Sr C_2$	158·5
„ „ (cryst.)	$Sr Cl_2 2H_2O$	194·5
„ iodide	$Sr I_2$	341 5
„ nitrate	$Sr (NO_3)_2$	211 5
Thiocarbamide	$CS (NH_2)_2$	76
Thiosinamine	$CS (NH_2) NH C_3 H_5$	116
Thymol	$CH_3 C_6 H_3 OH C_3 H_7$	150
Tin (Stannous) chloride	$Sn Cl_2 + 2H_2O$	225
Uranium, acetate	$UO_2 (C_2 H_3 O_2)_2 2H_2O$	426
„ chloride	UO_2Cl_2	343
„ nitrate	$UO_2 (NO_3)_2 6H_2O$	504
Zinc, sulphate	$Zn SO_4 7H_2O$	287

* Called "hyposulphite" by chemists. † Called "thiosulphate" by chemists.

TABLE OF THE SOLUBILITIES OF THE PRINCIPAL SUBSTANCES USED IN PHOTOGRAPHY.

sol.= *soluble;* v.s.=*very soluble;* s.s.=*slightly soluble;* dec.=*decomposed;* insol.=*insoluble.*

Name.	One part is soluble in — parts of water. Cold.	Boiling.	100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol &c.
Acetone	..	..	..	
,, sulphite	v.s.	..	..	s.s.
Acid, acetic	..	..	..	
,, benzoic	380	45	0·27	1 in 2 75 90%
,, boric	29	2·9	3½	1 in 28 90%
,, carbolic	15	..	6 6	v s.
,, chromic (anhydride)	0·6	v.s.	160	sol. with decomp
,, citric	¾	½	130	
,, formic	..	..	..	

Acetone.—(Sp. gr. 0·814), boils at 133°F. miscible in all proportions with water, alcohol and ether. 272 gms. dissolve in 100 gms 20% cane sugar solution at 60° F. A solvent of resin, fats, camphor, pyroxylin and celluloid.

Acetic Acid.—The "glacial" acid, which is that implied in formulæ unless a weaker acid is directed, solidifies about 50° Its sp gr. is 1·055; it boils at 245°F. It is a solvent of gelatine, celluloid, pyroxyline, fats, oils, etc., blisters the skin, strongly absorbs water from the air, and is miscible with water, alcohol, ether, chloroform and glycerine in all proportions.

Formic Acid.—A colourless liquid of 1 22 sp. gr. (=100% acid), miscible with water and alcohol. Weaker solutions are:—1·20 (90%); 1·18 (80%); 1·15 (65%); 1 12 (50%) and 1·06 (25%).

Hydriodic Acid.—A solution of the gas, HI, and obtainable as strong as sp. gr. 2·0 (=96% HI). Solution of sp. gr. 1.7 contains about 52%; sp. gr. 1 5, about 43%.

Hydrobromic Acid.—A solution of the gas, HBr., in water. The strongest solution has sp. gr. of 1 78 (=82%); sol. of 1 495 sp. gr. contains 48% HBr.; 1·38, 40%; 1·208, 25%.

Hydrochloric Acid.—A solution of the gas, HCl, in water. The commercial strongest acid has sp gr. 1 16, and contains about 30% HCl. Impure acid is sold as "spirits of salts."

Hydrocyanic Acid (=Prussic Acid).—The strength of the official acid of the British Pharmacopœia is 2%. A 10% acid is obtainable in the chemical trade. Both are the most deadly and dangerous poisons.

Hydrofluoric Acid is a strongly fuming solution of the gas HF.; it is sold of strengths 40% and 55% HF.

Lactic Acid is sold as a colourless syrupy liquid, miscible with water or alcohol. Sp. gr. 1·21. A weaker acid is also sold commercially containing 50% acid.

TABLE OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in — parts of water. Cold.	Boiling	100 parts of water dissolve at ordinary temperature	Solubility in Alcohol, &c.
Acid, gallic	100	0·3	1	1 in 5 90% alcohol 1 in 40 ether
,, oxalic	9 5	0·3	10½	
,, picric	100	..	1	1 in 10 90%, also in ether
,, pyrogallic	2¼	v s.	44	sol. also in ether, not in chloroform
,, salicylic	500	12½	⅛	1 in 3 5, 1 in 2 in ether
,, tannic	0 5	..	20	1 in 0·6, nearly insol. in ether
,, tartaric	¾	½	132	
Alum, ammonia	8 3	0 24	12	insoluble
,, chrome	6	dec	16	
,, iron ammonia	3	dec	33	insoluble
,, potash	10	v.s	9 6	insoluble
Aluminium, chloride	¼	v s.	400	soluble
,, sulphate	3	1 1	35	
Amidol	4	v s.	24	less sol. in alc. & eth.
Ammonium, bichromate	5	¼	20	1 in 31 absolute alc.
,, bromide	1·4	v s.	72	

Nitric Acid.—Strongly corrosive liquid of 1 42 sp gr. (=71% HNO_3); soluble in water, oxidises alcohol and other organic solvents.

Phosphoric Acid.—Sold as syrupy liquid, that of 1·75 sp. gr. (=about 90% acid), being intended when "phosphoric acid" is prescribed in formulæ.

Sulphuric Acid.—The commercial strong acid is a thick corrosive liquid of 1·84 sp. gr. (=98% H_2SO_4). It absorbs water rapidly from the air, and, mixed with water, great heat is developed. The acid should always be added to water—not *vice versa*.

Sulphurous Acid.—Solution in water of the gas SO_2; saturated solution of 1·046 is equivalent to 9·5% H_2SO_3, but soon loses strength.

Albumen.—On heating the cold solution to 160°F. the albumen separates in insoluble form. Alcohol similarly coagulates albumen.

Methyl Alcohol (sp. gr. 0 814).—The chief constituent of crude "wood spirit," or wood naphtha, in which is usually 10% of acetone.

Ethyl Alcohol forms "absolute alcohol" (sp. gr. 0 830 to 0 834), which contains from 2 to 5% water. Alcohol containing 16% water is "rectified spirit." "Methylated" spirit consists of rectified spirit *plus* 10% crude wood spirit and ⅜% mineral naphtha, the latter precipitating as a milkiness on addition of water. These various forms of alcohol mix with water, which can be abstracted with dry potassium carbonate.

Aluminium Chloride.—100 gms. saturated solution (sp. gr., 1·35) contains 41·1 gms. aluminium chloride.

TABLE OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in — parts of water. Cold.	Boiling.	100 water di at ord temper	Solubility in Alcohol, &c.
Ammonium carbonate ..	4	dec.	25	
„ chloride	3	1·4	35	
„ citrate......	½	v.s.	200	
„ iodide	0 6	v.s.	165	1 in 4 alc., s.s in ether
„ molybdate ..	2½	dec.	40	
„ nitrate	½	v.s.	200	
„ oxalate	23	2·4	4 3	sol.
„ persulphate	1½	dec.	65	
„ sulphocyanide	0 6	v.s.	160	v.s.
„ vanadate	s.s.	v.s.	..	
Antimony sulphide	insol.	..	..	
Aurantia	s.s.	..	..	v.s.; s.s. in ether
Aurine	s s.	..	..	sol.; also in ether
Barium bromide	0·75	0·5	133	v.s. in benzole
„ chloride	2·4	1·3	42	insol.
„ iodide	½	v s.	200	1 in 20 alcohol
„ nitrate..........	12	3 1	8	insol.
Bromine................	31	..	3·2	
Cadmium, bromide	0·94	v.s.	106	1 in 3 alc, 1 in 250 eth.
„ ammonium bromide	0·7	v.s.	137	
„ chloride	0·71	0·67	140	1 in 8 alcohol
„ iodide........	1·08	0·75	93	1 in 1 alc.; 1 in 3·6 eth.
Calcium, chloride (cryst)	¼	v s.	400	
„ „ (fused)	1·4	0·65	70	
„ sulphate	380	450	0 3	
„ hydroxide	700	1,300	0·137	
Ceric sulphate	12	200	8 3	
Chloral hydrate	¼	..	400	1 in 1/5 90%, 1 in 50 carbon bisulphide.
Copper bromide	v.s	v.s.	..	
„ chloride	0·83	v.s.	121	v.s.; also in ether.
„ sulphate	2½	½	40	
Cyanine................	s.s.	..	..	
Diamidophenol	sol.	..	..	

Ammonium Sulphocyanide is purchased as a reddish solution of 1·16 sp. gr.

Ammonium Sulphide is sold as a deep yellow solution containing also polysulphides.

Amyl Acetate.—Liquid of sp. gr. 0·876, miscible with alcohol and ether but not with water. A solvent of fats, oils, resin, pyroxyline and celluloid.

Amyl Alcohol, the chief constituent of fusel oil, is not miscible with water

Aniline (sp. gr. 1·036) is freely miscible with alcohol or ether, but only very slightly with water. It boils at 356° F. and coagulates albumen.

TABLE OF THE SOLUBILITIES, &c.—Continued.

Name.	One part is soluble in — parts of water. Cold.	Boiling.	100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
Edinol	sol.	..	..	[cohol or ether.
Eikonogen	25	..	4.2	nearly insol. in al-
Eosine	sol.	..	..	insol. in ether.
Ether	12	..	8	
Erythrosine	s.s.	..	..	s.s.
Gold, chloride	v.s.	v.s.	..	
Hydroquinone	17	..	6	
Iodine	insol.	insol.	..	sol.; also in carbon
IRON				bisulphide
Ferric chloride (lump)	v.s.	v.s.	..	
,, ,, (dry)	0·63	v.s.	160	
,, ammonium citrate (brown)*	4	..	25	
	..	..	..	
,, ,, (green)†	..	..	..	
,, ammonium oxalate	2·1	..	0·48	
,, potassium ,,	15	0·85	6·6	insol.
,, sodium ,,	1·69	0·55	60	
Ferrous chloride (dry)	2	v.s.	50	
,, ,, (cryst.)	0·68	v.s.	147	
,, oxalate	4500	3800	..	
,, sulphate	1·43	0·27	70	
,, am. sulphate§	3	..	33	
Lead, acetate	1½	0·5	66	1 in 15 alcohol
Lead, nitrate	2	0·7	50	insol. in ether
Lithia, caustic	s.s.	..	..	
Lithium, bromide	0·7	0·4	143	
,, carbonate	72	138	1·3	v.s.
,, chloride	1¼	0·8	80	
,, iodide	0·61	0·2	164	v.s.
Magnesium, chloride (dry)	1·7	1¼	60	v.s.
,, sulphate	1	0·15	100	
Manganese, sulphate	0·8	1	120	

Ether (called also "sulphuric ether") is very volatile and inflammable. Boils at 95° F., sp. gr. 0·722.

Formaline.—A commercial strong solution (40%) of formic aldehyde, CH_2O.

Gelatine becomes swollen in cold water and dissolves in hot. Dissolved in the cold by oxalic, acetic, hydrochloric, or nitric acid, barium chloride or chloral hydrate. Precipitated from its solution in water by alcohol.

Glycerine.—Miscible with water or alcohol. Sp. gr. 1·265.

Iodine dissolves freely also in carbon bisulphide or potassium iodide solution.

Ferric Oxalate is very soluble, over 20%, it is partially reduced to ferrous oxalate on heating the solution to 212° F.

§ Seven parts of ferrous sulphate correspond to 10 parts ferrous ammonium sulphate. * 21·7 to 22·4% iron. † 14 to 15% iron.

TABLE OF THE SOLUBILITIES, &c.—Continued.

Name.	One part is soluble in — parts of water. Cold.	Boiling	100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
Mercury, bichloride	16	1·8	6·3	insol. in absolute alc.
,, iodide	150	..	0·66	1 in 4 90%
Metol	sol.	..	..	
Ortol	sol.	..	..	s.s.; also in ether
Para-amido-phenol hydrochloride	10	..	10	1 in 22
Phenol (*see* acid carbolic)				
Potassium, bicarbonate	4	dec.	25	
,, bichromate	10	1	10	
,, borotartrate	¾	v.s.	135	
,, bromide	1½	1	65	
,, carbonate(dry)	0 9	0·64	112	1 in 750
,, chlorate	17	2	6	insol.
,, chloride	3	1·75	33	insol.
,, chloroplatinite	6	v.s.	17	
,, chromate	2	1 2	50	insol.
,, citrate	0·6	v.s.	166	insol.
,, cyanide	0·8	v.s.	122	v.s.
,, ferricyanide	2½	1·3	40	1 in 9
,, ferrocyanide	3·4	2	29	
,, hydrate	½	v.s.	200	insol.; insol. in eth.
,, iodide	0·7	½	140	sol.
,, metabisulphite	sol.	dec.	..	1 in 16, 90%
,, nitrate	3½	0 4	28	
,, nitrite	1	v.s.	100	
,, oxalate	3	v.s.	33	insol.
,, percarbonate	15	dec.	6·5	
,, perchlorate	100	5	1	
,, permanganate	16	..	6·25	
,, persulphate	50	dec.	2	
,, sulphocyanide	0·46	v.s.	220	insol. in absolute alc.
,, acid sulphate	2	0 8	50	
Pyrocatechin	1¼	v.s.	80	
Rochelle salt	1½	v.s.	66	
Schlippe's salt	3	v.s.	33	
Silver, acetate	100	..	1	
,, carbonate	insol.	..	..	
,, chlorate	5	2	20	
,, citrate[1]	insol.	..	..	
,, cyanide	insol.	..	..	
,, fluoride[2]	v.s.	v.s.	..	

1. Readily soluble in ammonia and hypo.
2. $AgF.4H_2O$ is almost as soluble as calcium chloride.

TABLE OF THE SOLUBILITIES, &c.—CONTINUED.

Name.	One part is soluble in — parts of water. Cold	Boiling	100 parts water dissolve at ordinary temperature.	Solubility in Alcohol, &c.
Silver, nitrate	0·44	0·1	227	1 in 26, 90%
" nitrite	s.s.	..	..	
" sulphate	87	..	1·15	
" sulphocyanide	insol.	..	..	
" tartrate	insol.	..	..	
Sodium, acetate	2·8	v.s.	36	1 in 50, 90%; insol. in [ether
" bicarbonate	11·3	dec.	8·8	
" bichromate	1	0·6	100	
" bisulphite	v.s.	..	..	
" borate	12½	½	8	
" bromide	1·1	0·9	90	1 in 15
" carbonate (dry)	6	2·2	16·2	
" " (cryst.)	1·56	v.s.	63·2	
" chloride	3	2½	33	
" chloroplatinate	sol.	..	..	
" citrate	sol.	..	..	s.s.
" fluoride	25	..	4	
" hydrate (caustic)	v.s.	v.s.	..	
" hyposulphite	0·6	v.s.	170	insol.
" iodide	0·6	0·4	166	
" nitrate	1·1	0·6	85	
" oxalate	35	..	3	
" phosphate	6·7	1	15	
" sulphide	v.s.	v.s.	..	
" sulphite (cryst.)	2·2	1	45	
" " (dry)	4	..	25	
" tri-basic phosphate	0·5	v.s.	20	
" tungstate	8 to 12	..	..	insol.
" (meta) vanadate	½	v.s.	200	
Strontium, bromide	1·01	½	100	1 in 30, 90%
" chloride	1·96	1	51	
" " (cryst.)	1·33	0·6	75	
" iodide	0·56	0·25	18	
" nitrate	1·41	1	71	
Thiocarbamide	11	v.s.	9	v.s. also in ether
Thiosinamine	17	..	6	1 in 2 90%; also in eth.
Thymol	330	..	0·3	1 in 3·75 90%; also in [ether.
Tin (stannous), chloride	1½	v.s	66	
Uranium, acetate		v.s.		
" chloride		v.s.		
" nitrate		v.s.	200	
Zinc, sulphate	0·62	0·15	161	

PERCENTAGE OF REAL AMMONIA IN SOLUTIONS OF DIFFERENT DENSITIES AT 14° C. (57° F.)—CARIUS.

Specific Gravity.	Percentage Ammonia	Specific Gravity.	Percentage Ammonia	Specific Gravity	Percentage Ammonia	Specific Gravity.	Percentage Ammonia
0·8844	36·0	0·9052	27·0	0·9314	18·0	0·9631	9·0
0·8864	35·0	0·9078	26·0	0·9347	17·0	0·9670	8·0
0·8885	34·0	0·9106	25·0	0·9380	16·0	0·9709	7·0
0·8907	33·0	0·9133	24·0	0·9414	15·0	0·9749	6·0
0·8929	32·0	0·9162	23·0	0·9449	14·0	0·9790	5·0
0·8953	31·0	0·9191	22·0	0·9484	13·0	0·9831	4·0
0·8976	30·0	0·9221	21·0	0·9520	12·0	0·9873	3·0
0·9001	29·0	0·9251	20·0	0·9556	11·0	0·9915	2·0
0·9026	28·0	0·9283	19·0	0·9593	10·0	0·9959	1·0

INDICATORS

(I.e., Colour Tests for Alkalies and Acids).

	Acid.	Alkaline.	In presence of Carbon Dioxide.
Litmus	Bright red	Blue	Reddish purple
Cochineal	Yellow	Reddish violet	Not affected
Methyl orange ..	Red	Yellow brown	Not affected
Phenol-phthalein	Colourless	Intense red	Useless

REACTION OF SUBSTANCES TO VARIOUS INDICATORS.

Substance.	Litmus.	Methyl Orange.	Phenol-phthalein.
Alum	acid	neutral	acid
Borax	alkaline	alkaline	neutral
Potass. metabisulphite.......	acid	neutral	acid
Potass. oxalate	neutral	neutral	neutral
Rochelle salt	neutral	neutral	neutral
Silver nitrate	acid	neutral	acid
Sodium bicarbonate	alkaline	alkaline	neutral
Sodium citrate	alkaline	alkaline	neutral
Sodium bisulphite	acid	neutral	acid
Sodium sulphite............	alkaline	alkaline	neutral
Sodium phosphate	neutral	alkaline	neutral

Thermometric Rules.

The following rules for the rapid conversion of degrees in one system into another will be found useful:—

To Convert Centigrade into Fahrenheit:

Degrees Centigrade $\times 9 \div 5 + 32$.

Ex.—80° C. $\times 9 \div 5 = 144 + 32 = 176^\circ$ F.

To Convert Fahrenheit into Centigrade:

(Degrees Fahrenheit $- 32) \times 5 \div 9$.

Ex.—100° F. $- 32 = 68 \times 5 \div 9 = 37{\cdot}8$ C.

To Convert Fahrenheit into Réaumur:

(Degrees Fahrenheit $- 32) \div 9 \times 4$.

Ex.—95° F. $- 32 = 63 \div 9 \times 4 = 28^\circ$ R.

To Convert Réaumur into Fahrenheit:

Degrees Réaumur $\times 9 \div 4 + 32$.

Ex.—16° R. $\times 9 \div 4 = 36 + 32 = 68^\circ$ F.

To Convert Centigrade into Réaumur:

Degrees Centigrade $\times 4 - 5$.

Ex.—60° C. $\times 4 \div 5 = 48^\circ$ R.

To Convert Réaumur into Centigrade

Degrees Réaumur $\times 5 \div 4$.

Ex.—80° R. $\times 5 \div 4 = 100^\circ$ C.

COMPARISON OF THERMOMETER SCALES.

Equivalence of Centigrade (Celsius) and Fahrenheit Thermometers.

Centigrade.	Fahrenheit.	Centigrade.	Fahrenheit.	Centigrade.	Fahrenheit.
0	32·0	35	95·0	70	158·0
1	33·8	36	96 8	71	159·8
2	35 6	37	98 6	72	161 6
3	37 4	38	100·4	73	163·4
4	39·2	39	102·2	74	165·2
5	41·0	40	104 0	75	167 0
6	42·8	41	105·8	76	168·8
7	44 6	42	107·6	77	170 6
8	46 4	43	109·4	78	172·4
9	48 2	44	111·2	79	174 2
10	50 0	45	113·0	80	176·0
11	51·8	46	114·8	81	177 8
12	53 6	47	116·6	82	179·6
13	55 4	48	118 4	83	181·4
14	57·2	49	120·2	84	183·2
15	59 0	50	122·0	85	185·0
16	60 8	51	123 8	86	186 8
17	62 6	52	125 6	87	188 6
18	64 4	53	127 4	88	190 4
19	66·2	54	129 2	89	192 2
20	68 0	55	131 0	90	194·0
21	69 8	56	132 8	91	195 8
22	71 6	57	134 6	92	197 6
23	73 4	58	136 4	93	199·4
24	75·2	59	138 2	94	201 2
25	77·0	60	140 0	95	203 0
26	78 8	61	141·8	96	204·8
27	80·6	62	143 6	97	206·6
28	82 4	63	145·4	98	208 4
29	84 2	64	147·2	99	210 2
30	86·0	65	149·0	100	212·0
31	87 8	66	150·8	105	221·0
32	89·6	67	152·6	110	230·0
33	91·4	68	154·4	115	239·0
34	93·2	69	156·2	120	248·0

A TABLE OF ATOMIC WEIGHTS OF THE CHEMICAL ELEMENTS.

NAME.	Symbol.	Atomic Weight in Round Numbers	Accurate Atomic Weight.
Aluminium	Al	27	27·1
Antimony	Sb	120	120·2
Argon	A	40	39·9
Arsenic	As	75	75·0
Barium	Ba	137	137·43
Beryllium	Be = Gl	9 1	9·1
Bismuth	Bi	208	208·0
Boron	B	11	11 00
Bromine	Br	80	79 96
Cadmium	Cd	112	112·4
Cæsium	Cs	133	132·9
Calcium	Ca	40	40 1
Carbon	C	12	12·0
Cerium	Ce	140	140·25
Chlorine	Cl	35 5	35·451
Chromium	Cr	52	52·11
Cobalt	Co	59	59 00
Copper	Cu	63 5	63 60
Erbium	Er	166	166 0
Fluorine	F	19	19·0
Gadolinium	Gd	156	156·01
Gallium	Ga	70	70·0
Germanium	Ge	72·5	72·5
Gold	Au	197	197·2
Helium	He	4	4·0
Hydrogen	H	1	1·008
Indium	In	115	115·0
Iodine	I	127	126·97
Iridium	Ir	193	193 0
Iron	Fe	56	55·9
Lanthanum	La	139	138 9
Lead	Pb	207	206 92
Lithium	Li	7	7·03
Magnesium	Mg	24	24·36
Manganese	Mn	55	55·0
Mercury	Hg	200	200·0

A TABLE OF ATOMIC WEIGHTS—CONTINUED.

NAME.	Symbol.	Atomic Weight in Round Numbers.	Accurate Atomic Weight
Molybdenum	Mo	96	96·0
Neodymium	Nd	144	143·6
Nickel	Ni	59	58·70
Niobium	Nb=Cb	94	94·0
Nitrogen	N	14	14·04
Osmium	Os	191	191·0
Oxygen (Standard)	O	16	16·0
Palladium	Pd	106	106·5
Phosphorus	P	31	31·0
Platinum	Pt	193·4	194 8
Potassium	K	39	39·15
Praseodymium	Pr	141	140·5
Rhodium	Rh	103	103·0
Rubidium	Rb	85	85·5
Ruthenium	Ru	102	101·7
Samarium	Sm	150	150·3
Scandium	Sc	44	44·1
Selenium	Se	79	79·2
Silicon	Si	28	28·4
Silver	Ag	108	107·93
Sodium	Na	23	23·05
Strontium	Sr	87·5	87·6
Sulphur	S	32	32·06
Tantalum	Ta	183	183·0
Tellurium	Te	128	127·6
Terbium	Tb	160	160·0
Thallium	Tl	204	204·1
Thorium	Th	233	232·5
Thulium	Tu	171	171·0
Tin	Sn	118	119·0
Titanium	Ti	48	48·1
Tungsten	W	184	184·0
Uranium	U	240	238·5
Vanadium	V	51	51·4
Ytterbium	Yb	173	173·0
Yttrium	Yt	89	89·0
Zinc	Zn	65	65·4
Zirconium	Zr	91	90·6

TABLE OF POISONS AND ANTIDOTES. Compiled by J. Elsden.

	Poisons.	Remarks.	Characteristic Symptoms.	Antidote.
Vegetable Acid.	Oxalic Acid, including Potassium Oxalate	1 drachm is the smallest fatal dose known.	Hot burning sensation in throat and stomach; vomiting, cramps, and numbness.	Chalk, whiting, or magnesia suspended in water. Plaster or mortar can be used in emergency.
Caustic Alkalies.	Ammonia, Potash, Soda	Vapour of ammonia may cause inflammation of the lungs	Swelling of tongue, mouth, and fauces, often followed by stricture of the œsophagus	Vinegar and water.
Metallic Salts.	Mercuric Chloride	3 grains the smallest known fatal dose.	Acrid, metallic taste, constriction and burning in throat and stomach, followed by nausea and vomiting.	White and yolk of raw eggs with milk. In emergency, flour paste may be used.
	Acetate of Lead	The sub-acetate is still more poisonous	Constriction in the throat and at pit of stomach, crampy pains and stiffness of abdomen; blue line round the gums.	Sulphates of soda or magnesia. Emetic of sulphate of zinc.
	Cyanide of Potassium	a. Taken internally, 3 grs. fatal.	Insensibility, slow gasping respiration, dilated pupils, and spasmodic closure of the jaws.	No certain remedy; cold affusion over the head and neck most efficacious.
		b. Applied to wounds and abrasures of the skin.	Smarting sensation.	Sulphate of iron should be applied immediately
	Bichromate of Potassium	a. Taken internally.	Irritant pain in stomach and vomiting	Emetics and magnesia, or chalk.
		b. Applied to slight abrasions of the skin.	Produces troublesome sores and ulcers.	
	Nitrate of Silver		Powerful irritant.	Common salt to be given immediately, followed by emetics.
Concentrated Mineral Acids.	Nitric Acid	2 drachms have been fatal. Inhalation of the fumes has also been fatal.	Corrosion of windpipe and violent inflammation.	Bicarbonate of soda, or carbonate of magnesia or chalk, plaster of the apartment beaten up in water.
	Hydrochloric Acid	½ ounce has caused death.		
	Sulphuric Acid	1 drachm has been fatal.		
	Acetic Acid, concentrated, has as powerful an effect as the mineral acids.			
	Iodine	Variable in its action; 3 grains have been fatal.	Acrid taste, tightness about the throat, vomiting.	Vomiting should be encouraged and gruel, arrowroot and starch given freely.
	Ether	When inhaled.	Effects similar to chloroform.	Cold affusion and artificial respiration.
	Pyrogallic Acid	2 grains sufficient to kill a dog.	Resembles phosphorus poisoning.	No certain remedy. Speedy emetic desirable.

ORTHOCHROMATIC DATA.

DISTRIBUTION OF THE COLOURS IN THE SPECTRUM.

(ACCORDING TO LISTING.)

Colour		Wave length.
BROWN	Limit	819·8
	Middle	768·6
RED	Limit	723·4
	Middle	683·2
ORANGE	Limit	647·2
	Middle	614·9
YELLOW	Limit	585·6
	Middle	559·0
GREEN	Limit	534·7
	Middle	512·4
CYAN BLUE	Limit	491·9
	Middle	473·0
INDIGO	Limit	455·5
	Middle	439·2
VIOLET	Limit	424·0
	Middle	409·9
LAVENDER	Limit	396·7
	Middle	384·3
	Limit	372·6

WAVE LENGTHS OF BRIGHT LINES OF ELEMENTS USED IN PLOTTING OUT THE SPECTRUM.

(IN TEN-MILLIONTHS OF A MILLIMETRE ANGSTROM UNITS.)

TABLE I.

Name of line.	Colour.	Salts used.	Wave lengths = λ
Lithium	Red	Lithium chloride or nitrate ..	6705
Lithium	Orange	Lithium chloride or nitrate ..	6102
D	Orange	Sodium chloride or bicarbonate	5893
"Little b"	Green	Magnesium ribbon	5183
Strontium	Blue	Strontium chloride or metal ..	4607
Calcium	Blue	Calcium nitrate or chloride ..	4227
Potassium	Violet	Potassium chloride	4080

Table I. has been drawn up so as to enable any one with nothing more than an ordinary Bunsen gas burner to construct a chart, by means of which the position of any Fraunhofer line in the spectrum may be determined with sufficient accuracy for all photographic purposes. The salts should be dissolved in distilled water so as to form a saturated solution, a narrow loop of copper or iron wire should be wound with fibrous asbestos, and this repeatedly heated in the Bunsen and allowed to cool.

TABLE II.

C	Red	Hydrogen tube ..	6563
"Little b"	Green	Magnesium rod ..	5183
F	Bluish-green	Hydrogen tube ..	4861
Magnesium	Blue	Magnesium rod	4481
G	Blue	Hydrogen tube	4308
"Little h"	Blue	Hydrogen tube	4102

Table II. will give the data, most easily obtained if a small induction coil is used. A small coil, giving a fat ½ or ¾ in. spark, and actuated by three bichromate bottles will suffice to show the lines in this table. The hydrogen tube is, of course, of the well-known Plucker or Salet form. The magnesium may be used in twisted spirals of ribbon, but preferably in rod form, and the rods should be filed to comparatively sharp points. The constricted portion of the vacuum tube and the points of the magnesium rod should be placed parallel to and not at right angles to the slit.

EXPOSURE TABLES.

The following table, based on that of Burton, gives a rough idea of the exposures for various subjects and diaphragms under the following conditions:—

1. Best lighting, midday sunshine in May, June, and July.
2. With the most rapid commercial plates. See below for factors applying to other conditions.

F/ No.	Average Subject with objects in Foreground. Street Scenes. Outdoor Figure Studies	Landscapes with Light Foreground, Lake, River, and Beach Scenes.	Sea Clouds and Sky.	Subjects with Extra Heavy Foreground, &c., Dark Trees, Doorways, Groups	Under Trees, Woods, Avenues, Glades, etc.	Portrait in Average Well-lighted Room.
f/4	1/250	1/500	—	1/120	1/20	1/8
f/4·5	1/200	1/400	—	1/100	1/15	1/7
f/5·6	1/130	1/250	—	1/64	1/10	1/4
f/6·3	1/100	1/200	1/1000	1/50	1/8	1/3
f/7	1/80	1/150	1/800	1/40	1/7	2/5
f/8	1/64	1/120	1/600	1/30	1/5	1/2
f/11	1/30	1/60	1/300	1/15	1/2	1
f/16	1/15	1/30	1/150	1/8	1	2
f/22	1/8	1/15	1/80	1/4	2	4
f/32	1/4	1/8	1/40	1/2	4	8
f/45	1/2	1/4	1/20	1	8	16
f/64	1	1/2	1/10	2	16	30

In weather other than bright sunshine the above exposures are multiplied as follows :—

Bright diffused light, the sun behind a cloud	$\times 1\frac{1}{2}$	Heavy clouds over the whole sky. Absence of distinct shadows ..	$\times 3$
Light clouds over the whole sky, but light able to cast a visible shadow	$\times 2$	Very dull. Whole sky covered by still heavier clouds	$\times$ 4 to 5

At other hours of the day and times of the year the above exposures are multiplied by the numbers in the following table of daylight variation. The figure 1 in the table indicates times for which the above exposures are correct.

VARIATION IN DAYLIGHT FROM MORNING UNTIL EVENING (FOR LATITUDE OF BRITISH ISLES, NORTH GERMANY, ETC).

	MORNING.								
	12	11	10	9	8	7	6	5	4
January ..	$3\frac{1}{2}$	4	5	12					
February ..	2	$2\frac{1}{2}$	3	4	10				
March	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2	3	6			
April	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$	2	3	6		
May	1	1	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$2\frac{1}{2}$	3	6	
June	1	1	1	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	5	12
July	1	1	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$2\frac{1}{2}$	3	6	
August	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$	2	3	6		
September ..	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2	3	6			
October.. ..	2	$2\frac{1}{2}$	3	4	10				
November ..	$3\frac{1}{2}$	4	5	12					
December ..	$4\frac{1}{2}$	5	6						
	12	1	2	3	4	5	6	7	8
	AFTERNOON.								

A MENTAL RULE FOR TELEPHOTO EXPOSURES.

(CAPTAIN OWEN WHEELER.)

Assume that the positive is used at $f/16$. With a meter or by any other means find the exposure required in the ordinary way for stop $f/64$, making due allowance for distance and character of subject. Then multiply the time of exposure thus found by the necessary factor given in the following table for various magnifications :—

For 4 magnifications	× 1	For 10 magnifications	× 6
5 ,,	× 1½	11 ,,	× 7
6 ,,	× 2	12 ,,	× 8
7 ,,	× 3	13 ,,	× 10
8 ,,	× 4	14 ,,	× 12
9 ,,	× 5		

If the tele-positive is stopped to $f/11$ or $f/8$, the exposure on which the method is based must be taken as for $f/45$ or $f/32$, as the case may be.

PINHOLE EXPOSURES. (WATKINS-POWER NUMBERS.*)

W P. No.	Diameter.		Nearest Needle Size.	Good Working Distance.
	Inch.	Inch.		Inches.
1	0 160	$\frac{1}{7}$	—	—
2	0 080	$\frac{1}{13}$	—	—
3	0 053	$\frac{1}{19}$	1	40
4	0 040	$\frac{1}{25}$	4	20
5	0 032	$\frac{1}{31}$	5	14
6	0 027	$\frac{1}{38}$	7	10
7	0 023	$\frac{1}{44}$	8	8
8	0 020	$\frac{1}{50}$	10	5

Rule for use of W.P No in Column 1.—Multiply W P. No. of aperture by its working distance from plate. Use the result as the f/No in calculating exposure by meter, tables or other means. Whatever the calculated result is in seconds or fractions of a second, expose that number of minutes or fractions of a minute. Example.—W.P. 6 at 8 inches—calculate as f/48

* The principle of this system will be understood from a consideration of an example of focal aperture:—A $\frac{1}{4}$-inch aperture at 9 inches = f/36 If every second on the actinometer is to be reckoned a minute, the aperture must be one-sixtieth the *area*, that is the diameter must be divided by $\sqrt{60}$ or, near enough, by $\sqrt{64} = 8$. Therefore, an aperture of $\frac{1}{4} \div 8 = \frac{1}{32}$ inch diameter = f/36 when minutes are given instead of seconds. Therefore, reasoning backwards, a pinhole of $\frac{1}{32}$-inch diameter is called No. 4 (32 ÷ 8). Similarly one of half the diameter is No 8, and so on. Mr. Watkins, in order to allow for the exposure in excess of the theoretical which is needed in pinhole photography, calculates minutes as seconds at $\frac{1}{40}$ instead of $\frac{1}{60}$, the *area* of aperture, and therefore his so-called W.P. (Watkins-Power number) is obtained by dividing the denominator of the fraction which expresses the diameter of the pinhole by 6·3 instead of 8. Thus, in the case of a $\frac{1}{38}$-diameter hole, 38 ÷ 6·3 = 6·2, or, near enough, W.P. No. is 6.

SHUTTER SPEEDS FOR MOVING OBJECTS.

From the "Wellcome Exposure Record and Diary."

The formula and table given below indicate the shutter speeds necessary to secure negatives sufficiently sharp for direct printing. For enlarging it is better to give ½ to ⅓ these exposures, or to work further from the object. *The figures are no guide to what is the correct exposure for the plate.*

If D = distance of object in feet, F = focal length of lens, S = speed of object in feet per second, and E = exposure for an object moving across the field of view, then

$$E \quad \frac{D}{100\,F \times S}$$

The following table gives in round figures the shutter speeds necessary for various moving objects, using the ordinary quarter plate lens of about 5 in. focus. The column A is for objects moving directly towards the operator, B for objects moving obliquely towards or from the camera, that marked C for objects moving directly across the field of view.

Distance of Object, 25 ft., unless otherwise stated.	A.	B	C
Street groups (no rapid motion)		1/5 to 1/10	
Pedestrians (two miles per hour) .. } Animals grazing	1/20	1/40	1/60
Pedestrians (three miles per hour) ..	1/30	1/60	1/90
Pedestrians (four miles per hour)	1/40	1/80	1/120
Vehicles (six miles per hour)	1/60	1/120	1/180
Vehicles (eight miles per hour)	1/80	1/150	1/250
Cyclists and trotting horses	1/160	1/300	1/500
Foot races and sports	1/240	1/500	1/700
Divers	—	1/600	1/800
Cycle races, horse galloping	1/300	1/750	1/900
Yachts (10 knots per hour) at 50 ft. ..	1/60	1/120	1/180
Steamers (20 knots per hour) at 50 ft. ..	1/120	1/240	1/360
Trains (30 miles per hour) at 50 ft. ..	1/150	1/300	1/450
Trains (60 miles per hour) at 50 ft. ..	1/300	1/600	1/900

At 50 ft. the exposure may be double that at 25 ft.
At 100 ft. the exposure may be double that at 50 ft.

OPTICAL CALCULATIONS.

FINDING THE FOCAL LENGTH OF A LENS.

As simple and accurate a method as any is first to focus the lens on an object at an infinite distance (see table on page 717), and to mark the position of any convenient part of the moving lens front on the fixed camera baseboard, then place any object such as a foot rule before the camera, and focus—by moving only (1) camera as a whole and (2) camera front on baseboard, not back of camera—until image on screen is same size as original. The distance through which the camera front has to be moved to secure this is the focal length of the lens, and is indicated by the separation of the mark on the fixed baseboard from that on the lens front in its final (same-size) position.

FOCAL DISTANCES WHEN COPYING ON A REDUCED SCALE.

When reducing an original x times (linear), distance from original to lens is found by *multiplying* focal length of lens by x and adding one focal length.

Example.—Reducing 12 in. to 4 in. (reduction of 3 linear) with 6 in. lens, distance from original to lens is $6 \times 3 + 6 = 24$ in.

Distance from lens to plate is found by *dividing* focal length by x and adding one focal length.

Thus (conditions as above) $6 \div 3 + 6 = 8$ in.

FOCAL DISTANCES WHEN ENLARGING WITH CAMERA OR LANTERN.

When enlarging a negative x times (linear), distance from negative to lens is found by *dividing* focal length of lens by x and adding one focal length.

Example.—4 inches in negative to 16 inches in enlargement, that is x equals 4. With lens of 8 inch focus, distance from lens to negative is $8 \div 4 + 8 = 10$ in.

Distance from lens to sensitive paper or plate is found by *multiplying* focal length of lens by x and adding one focal length.

Thus (conditions as above) $8 \times 4 + 8 = 40$ in.

"CONJUGATES" AND "EXTRA FOCAL" DISTANCES.

The full distances: (1) lens to plate, and (2) lens to original, are called the "conjugate focal lengths."

Imagine a solid bar projecting in front of and behind the lens to a distance in each case equal to the focal length of the lens. The

distances from opposite ends of the imaginary bar to the original and plate respectively are the "extra focal distances" (E.F.D.). They are the conjugates less one focal length.

MENTAL LENS CALCULATIONS.

By using the "extra focal distances" lens calculations become much more readily done in the head, remembering that —

When copying or enlarging, say, 4 times, the greater "extra focal distance" is four times the focal length of the lens, and the smaller "extra focal distance" one-fourth the focal length of the lens. Similarly for a 5-times reduction or enlargement, the greater E.F D. is five times the focal length; the smaller, one-fifth the focal length.

By adding one focal length to each of these E.F.D.'s we get the actual distances from plate and original to lens.

STUDIO CALCULATIONS.

(By the E.F.D. Method.)

To calculate what length of studio is necessary for work of a given kind with a given lens, it is convenient to take the height of the average sitter as:—

Full length standing	68 inches
Head and shoulders	30 inches

When making portraits in the sizes of prints in common use, the degrees of reduction are those given in the following table:—

Name and Size of Photograph.	C. de V.	Cabinet.	Boudoir.*	Imperial.†
Height of image on photograph	3	5	7½	9
For full-length portrait, reduction figure is	23	13	9	7½
For head and shoulders portrait, reduction figure is	10	6	4	3 nearly

* 8¼ × 5 † 10 × 6¾.

These few figures and the E.F.D. rule given above are all that is required for the ordinary studio calculations.

Thus we want to know what descriptions of work can be done, say, in a studio 18 ft. long with a 10 in. lens, that is we want to find the reduction figure possible in these conditions.

In all calculations of studio working space 6 ft ought to be subtracted from the wall-to-wall length. The sitter will usually be 3 ft. in front of the back wall, and the photographer wants about the same space behind the camera.

Therefore, working space is 12 ft. = 144 in.

Subtracting 2 focal lengths (20 inches), the space for the two E.F.D.'s is 124 ins. As the smaller E.F.D. is only an inch or so (a fraction of the focal length), it is near enough to take this 124 ins. as the front E.F.D. Dividing it by the focal length,

$$124 \div 10 = 12\tfrac{1}{2},$$

we get the reduction figure, showing that the greatest reduction we can get is not quite enough for full length cabinets.

Similar studio calculations are readily made, bearing in mind that the total wall-to-wall length is parcelled out thus:—

E.F.D. towards object. (large).
E.F.D. towards image (small).
Two focal lengths.
Space for sitter and operator (6 ft.).

Remember, too, that the object E.F.D is equal to the focal length × the reduction figure, whilst the image E.F.D is the focal length ÷ the reduction figure, and is, therefore, never more than an inch or two at the most.

SHORTENING AND INCREASING THE FOCAL LENGTH OF A LENS.

The rule (very rough, on account of the impossibility of knowing from which part of a lens-mount to measure) for finding the focal length of an extra lens, to reduce or increase the focal length of a given lens, is.—

Multiply the focal length to be altered by the final focal length desired, and divide the product by the original focal length less the final focal length.

That is: $$f_2 = \frac{f_1 \times F}{f_1 - F}$$

where f_1 is the original focal length,
F the final focal length required,
and f_2 the focal length of the necessary added lens.

To increase the focal length use a negative lens.
To reduce the focal length use a positive lens.

MAGNIFIERS.

When using a supplementary lens (magnifier) as a means of bringing near objects into focus, the focal length of the supplementary lens must be equal to the distance of the object. This holds good whatever the focal length of the original lens.

TELEPHOTO CALCULATIONS.

F = equivalent focal length of complete lens.
f_1 = equivalent focal length of positive.
f_2 = equivalent focal length of negative.
E = camera extension, from negative lens to ground glass.
M = magnification, that is number of times the image given by the complete lens is larger than that given by positive alone.

Magnification when working at given extension is found by dividing camera extension by focal length of negative lens and adding 1.

$$M = \frac{E}{f_2} + 1.$$

Camera extension, necessary for given magnification—multiply focal length of negative lens by magnification less 1.

$$E = f_2\,(M-1)$$

Focal length of complete lens.—Multiply focal length of positive by magnification.

STEREOSCOPIC FACTS AND FIGURES.

To secure correct conditions of convergency each print must be seen under the same angle of view as that at which it was produced, and the two prints must be mounted in accord with the following rules:—

Let P = separation of any pair of corresponding points on prints.
N = separation of same points on negatives.
E = separation of eyes (average is 64 mm.).
L = separation of camera lenses.

A non-prismatic stereoscope being used:—

1. If image points represent infinitely distant objects, make $P = E$.

2. If only near objects are shown and an ordinary single plate double lens stereo camera has been used

Make $P = E + L - N$.

3. If a single camera is used for two separate exposures, or if two separate similar cameras are used together, measure N with negatives placed edge to edge and in the same relative positions that they occupied during exposure, and then

Make $P = E - N +$ length of one plate.

If a prismatic stereoscope, fitted with properly centred half lenses is used, add the width of one prism to above values of P.

DIAPHRAGM NUMBERS.

Equivalent F/- and Uniform System Numbers.

Rel. Exposure Req'd..	1	2	4	8	16	32	64	128
F Nos.	4	5·6	8	11·3	16	22·6	32	45·2
U.S. Nos.	1	2	4	8	16	32	64	128

Note.—Most lenses are now marked with the f/ numbers, although the U.S. numbers are used on Kodak lenses. Also the actual diameter of the diaphragm aperture in millimetres is marked on Zeiss lenses, such as the "Convertible."

APPROXIMATE INFINITY FOR LENSES OF VARIOUS FOCAL LENGTHS.

By C. Welborne Piper, from "The First Book of the Lens."

FOCAL LENGTH, INCHES.	DISTANCE OF FOCUSSING-SCREEN BEHIND PRINCIPAL FOCUS.			
	$\frac{1}{100}$ in.	$\frac{1}{250}$ in.	$\frac{1}{500}$ in.	$\frac{1}{1000}$ in.
1	3 yds.	7½ yds.	15 yds.	30 yds.
2	11 ,,	28 ,,	55 ,,	110 ,,
3	25 ,,	63 ,,	125 ,,	250 ,,
4	45 ,,	113 ,,	225 ,,	450 ,,
5	70 ,,	175 ,,	350 ,,	700 ,,
6	100 ,,	250 ,,	500 ,,	1000 ,,
7	136 ,,	340 ,,	680 ,,	1360 ,,
8	178 ,,	¼ mile	½ mile	1 mile
9¾	264 ,,	660 yds.	¾ ,,	1½ miles
11¼	351 ,,	½ mile	1 ,,	2 ,,
12½	434 ,,	1085 yds.	1¼ miles	2½ ,,
13¾	525 ,,	¾ mile	1½ ,,	3 ,,
16	700 ,,	1 ,,	2 ,,	4 ,,
17¾	875 ,,	1¼ miles	2½ ,,	5 ,,
19½	1056 ,,	1½ ,,	3 ,,	6 ,,
21	1225 ,,	1¾ ,,	3½ ,,	7 ,,
22½	1406 ,,	2 ,,	4 ,,	8 ,,
24	1600 ,,	2¼ ,,	4½ ,,	9 ,,
25	1 mile	2½ ,,	5 ,,	10 ,,
28	1¼ miles	3¼ ,,	6½ ,,	13 ,,
30	1½ ,,	3¾ ,,	7½ ,,	15 ,,
33	1¾ ,,	4½ ,,	9 ,,	18 ,,
35	2 ,,	5 ,,	10 ,,	20 ,,

By focussing accurately on distances not less than those given, we ensure that the focussing-screen is within $\frac{1}{100}$, $\frac{1}{250}$, $\frac{1}{500}$, or, $\frac{1}{1000}$ in. from the true principal focus.

DISTANCES WHEN ENLARGING AND REDUCING.

Focus of Lens, inches	TIMES OF ENLARGEMENT AND REDUCTION.							
	1	2	3	4	5	6	7	8
	inches	inches	inches	inches	inches	inches	inches	inches
3	6 6	9 4 1/2	12 4	15 3 3/4	18 3 3/5	21 3 1/2	24 3 3/7	27 3 3/8
3 1/2	7 7	10 1/2 5 1/4	14 4 2/3	17 1/2 4 3/8	21 4 1/5	24 1/2 4 1/12	28 4	31 1/2 3 15/16
4	8 8	12 6	16 5 1/3	20 5	24 4 4/5	28 4 2/3	32 4 4/7	36 4 1/2
4 1/2	9 9	13 1/2 6 3/4	18 6	22 1/2 5 5/8	27 5 2/5	31 1/2 5 1/4	36 5 1/7	40 1/2 5 1/16
5	10 10	15 7 1/2	20 6 2/3	25 6 1/4	30 6	35 5 5/6	40 5 5/7	45 5 5/8
5 1/2	11 11	16 1/2 8 1/4	22 7 1/3	27 1/2 6 7/8	33 6 3/5	38 1/2 6 5/12	44 6 2/7	49 1/2 6 3/16
6	12 12	18 9	24 8	30 7 1/2	36 7 1/5	42 7	48 6 6/7	54 6 3/4
7	14 14	21 10 1/2	28 9 1/3	35 8 3/4	42 8 2/5	49 8 1/6	56 8	63 7 7/8
8	16 16	24 12	32 10 2/3	40 10	48 9 3/5	56 9 1/3	64 9 1/7	72 9
9	18 18	27 13 1/2	36 12	45 11 1/4	54 10 4/5	63 10 1/2	72 10 2/7	81 10 1/8
10	20 20	30 15	40 13 1/3	50 12 1/2	60 12	70 11 2/3	80 11 3/7	90 11 1/4
11	22 22	33 16 1/2	44 14 2/3	55 13 3/4	66 13 1/5	77 12 5/6	88 12 4/7	99 12 3/8
12	24 24	36 18	48 16	60 15	72 14 2/5	84 14	96 13 5/7	108 13 1/2

The table is used as follows:—Knowing the focal length of the lens to be used and the degree of (linear) enlargement or reduction, look up the figure for enlargement or reduction in the upper horizontal row, and carry the eye down the column below it until it reaches the horizontal line of figures opposite the focal length of lens in the left-hand column.

When *enlarging*, the greater of the two distances where the two lines join is the distance from lens to the sensitive paper or plate. The lesser is the distance from lens to negative, or picture being enlarged direct in camera.

When *reducing*, the distances are *vice-versâ*: the greater is the distance from lens to original, the smaller from lens to sensitive plate.

RELATIVE EXPOSURES WHEN ENLARGING (WITHOUT A CONDENSER).

New Times of Enlargement.	Times of enlargement for which exposure is known.											
	1	1½	2	2½	3	3½	4	5	6	8	10	12
1	1	2/3	4/9	1/3	1/4	1/5	1/6	1/9	1/12	1/20	1/30	1/40
1½	1½	1	3/4	1/2	2/5	1/3	1/4	1/6	1/8	1/12	1/20	1/30
2	2¼	1½	1	3/4	3/5	2/5	1/3	1/4	1/5	1/9	1/12	1/20
2½	3	2	1¼	1	3/4	3/5	1/2	1/3	1/4	1/6	1/10	1/15
3	4	2½	1⅘	1¼	1	3/4	2/3	2/5	1/3	1/5	1/8	1/11
3½	5	3½	2¼	1¾	1¼	1	4/5	1/2	2/5	1/4	1/6	1/8
4	6	4	3	2	1½	1¼	1	3/4	1/2	1/3	1/5	1/7
5	9	6	4	3	2¼	1¾	1½	1	3/4	2/5	1/3	1/5
6	12	8	5	4	3	2½	2	1¼	1	3/5	2/5	2/7
8	20	13	9	7	5	4	3½	2¼	1¾	1	2/3	1/2
10	30	19	13	10	7	6	5	3½	2½	1½	1	3/4
12	42	27	19	14	11	8	7	4½	3½	2	1½	1

To use this table find in the top horizontal line the number of times of enlargement for which exposure is known. Under this number the relative time of exposure for different degrees of enlargement will be found opposite the new times of enlargement in first vertical column.

RELATIVE EXPOSURES WHEN COPYING OR REDUCING

New Scales of Reduction.	Scale of reduction for which exposure is known.											
	1	3/4	2/3	1/2	1/3	1/4	1/5	1/6	1/8	1/10	1/20	1/30
1	1	1¼	1⅓	1¾	2¼	2½	3	3	3	3½	3½	3½
3/4	3/4	1	1 1/10	1⅓	1¾	2	2	2¼	2½	2½	3	3
2/3	3/4	7/8	1	1¼	1½	1¾	2	2	2¼	2¼	2½	2½
1/2	3/5	3/4	4/5	1	1¼	1½	1½	1¾	2	2	2	2
1/3	2/5	3/5	2/3	4/5	1	1⅙	1¼	1¼	1½	1½	1½	1¾
1/4	2/5	1/2	3/5	3/4	7/8	1	1	1⅛	1¼	1¼	1½	1½
1/5	2/5	1/2	1/2	3/5	4/5	1	1	1	1⅛	1⅕	1¼	1¼
1/6	1/3	2/5	1/2	3/5	3/4	7/8	1	1	1	1⅛	1⅕	1¼
1/8	1/3	2/7	2/5	3/5	3/4	4/5	7/8	1	1	1	1 1/10	1⅛
1/10	1/3	2/5	2/5	1/2	3/5	3/4	4/5	7/8	1	1	1	1⅛
1/20	2/7	2/5	2/5	1/2	3/5	3/4	4/5	7/8	1	1	1	1
1/30	1/4	3/8	2/5	1/2	3/5	3/4	3/4	7/8	7/8	7/8	1	1

To use this table find in the top horizontal line the scale of reduction for which exposure is known. Under this scale the relative time of exposure for different degrees of reduction will be found opposite the new scales of reduction marked in first vertical column.

TABLE OF VIEW-ANGLES.

DIVIDE THE BASE* OF THE PLATE BY THE EQUIVALENT FOCUS OF THE LENS.

If the quotient is	The angle is	If the quotient is	The angle is	If the quotient is	The angle is
	Degrees.		Degrees.		Degrees.
0·282	16	0·748	41	1·3	66
0·3	17	0·768	42	1·32	67
0 317	18	0·788	43	1·36	68
0·335	19	0·808	44	1·375	69
0 353	20	0·828	45	1·4	70
0·37	21	0 849	46	1·427	71
0 389	22	0·87	47	1 45	72
0 407	23	0·89	48	1·48	73
0·425	24	0 911	49	1·5	74
0·443	25	0·933	50	1 53	75
0·462	26	0·954	51	1 56	76
0 48	27	0 975	52	1 59	77
0 5	28	1·0	53	1·62	78
0 517	29	1 02	54	1·649	79
0·536	30	1·041	55	1 678	80
0·555	31	1·063	56	1·7	81
0 573	32	1 086	57	1·739	82
0·592	33	1·108	58	1 769	83
0·611	34	1 132	59	1·8	84
0·631	35	1 155	60	1·833	85
0·65	36	1 178	61	1·865	86
0·67	37	1 2	62	1·898	87
0·689	38	1·225	63	1·931	88
0·708	39	1·25	64	1·965	89
0·728	40	1·274	65	2·0	90

Example.—Given a lens of 13 inches equivalent focus; required the angle included by it on plate 3¼ × 4¼.

Diagonal is 5·3 inches. 5·3÷13 ·407, corresponding with angle of 23°.

* More accurately the diagonal of the plate, inasmuch as the field of the lens is circular, and if the corners of the plate are to be covered the angle embraced by the lens should be sufficient to cover the diagonal of the plate. The maker of a lens, stated to cover up to a given angle, may be asked if that angle is measured on the length or diagonal of a plate.

The lengths of the diagonals of the plates most commonly used are :—

3¼ × 3¼	diagonal	4·6	inches.	7½ × 5	diagonal	9 0	inches.
3¼ × 4¼	,,	5·3	,,	6½ × 8½	,,	10·7	,,
5 × 4	,,	6·4	,,	10 × 8	,,	12 8	,,
4¾ × 6½	,,	8·0	,,	12 × 10	,,	15·6	,,
7 × 5	,,	8·6	,,	15 × 12	,,	19·2	,,

E. M. NELSON'S TABLE OF DISTANCES FOR LANTERN PROJECTION.

Distance of Projection Lens from Screen, Mask being Three Inches.

Foci	4½		5		5½		6		7		8		9		10		11		12	14		15		16		18	
Disc.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft	in.	ft.	in.	ft.	in.	ft.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
5	7	10½	8	9	9	7½	10	6	12	3	14	0	15	9	17	6	19	3	21	24	6	26	3	28	0	31	6
6	9	4½	10	5	11	5½	12	6	14	7	16	8	18	9	20	10	22	11	25	29	2	31	3	33	4	37	6
7	10	10½	12	1	13	3½	14	6	16	11	19	4	21	9	24	2	26	7	29	33	10	36	3	38	8	43	6
8	12	4½	13	9	15	1½	16	6	19	3	22	0	24	9	27	6	30	3	33	38	6	41	3	44	0	49	6
9	13	10½	15	5	16	11½	18	6	21	7	24	8	27	9	30	10	33	11	37	43	2	46	3	49	4	55	6
10	15	4½	17	1	18	9½	20	6	23	11	27	4	30	9	34	2	37	7	41	47	10	51	3	54	8	61	6
11	16	10½	18	9	20	7½	22	6	26	3	30	0	33	9	37	6	41	3	45	52	6	56	3	60	0	67	6
12	18	4½	20	5	22	5½	24	6	28	7	32	8	36	9	40	10	44	11	49	57	2	61	3	65	4	73	6
13	19	10½	22	1	24	3½	26	6	30	11	35	4	39	9	44	2	48	7	53	61	10	66	3	70	8	79	6
14	21	4½	23	9	26	1½	28	6	33	3	38	0	42	9	47	6	52	3	57	66	6	71	3	76	0	85	6
15	22	10½	25	5	27	11½	30	6	35	7	40	8	45	9	50	10	55	11	61	71	2	76	3	81	4	91	6
16	24	4½	27	1	29	9½	32	6	37	11	43	4	48	9	54	2	59	7	65	75	10	81	3	86	8	97	6
18	27	4½	30	5	33	5½	36	6	42	7	48	8	54	9	60	10	66	11	73	85	2	91	3	97	4	109	6
20	30	4½	33	9	37	1½	40	6	47	3	54	0	60	9	67	6	74	3	81	94	6	101	3	108	0	121	6
25	37	10½	42	1	46	3½	50	6	58	11	67	4	75	9	84	2	92	7	101	117	10	126	3	134	8	151	6
30	45	4½	50	5	55	5½	60	6	70	7	80	8	90	9	100	10	110	11	121	141	2	151	3	161	4	181	6
35	52	10½	58	9	64	7½	70	6	82	3	94	0	105	9	117	6	129	3	141	164	6	176	3	188	0	211	6
40	60	4½	67	1	73	9½	80	6	93	11	107	4	120	9	134	2	147	7	161	187	10	201	3	214	8	241	6
45	67	10½	75	5	82	11½	90	6	105	7	120	8	135	9	150	10	165	11	181	211	2	226	3	241	4	271	6
50	75	4½	83	9	92	1½	100	6	117	3	134	0	150	9	167	6	184	3	201	234	6	251	3	268	0	301	6

TABLES OF DISTANCES AT AND BEYOND WHICH ALL OBJECTS ARE IN FOCUS WHEN SHARP FOCUS IS SECURED ON INFINITY.

Focal length of Lens in inches.	Ratio marked on Stops.													
	f/4	f/5·6	f/6	f/7	f/8	f/10	f/11	f/15	f/16	f/20	f/22	f/32	f/44	f/64
	Number of feet after which all is in focus.													
4	33	24	22	19		13	12	9	8	7	6	4	3	–
4¼	38	27	25	21	19	15	14	10	10	7	7	5	3½	2½
4½	42	30	28	24	21	17	15	11	11	8½	7½	5½	4	3
4¾	47	34	31	27	24	19	17	12	12	9½	8½	6	5	3
5	52	36	35	30	26	21	19	14	13	10½	9½	6½	5½	3½
5¼	57	40	38	33	28	23	21	15	14	11½	10½	7	5½	3½
5½	63	45	43	36	31	25	23	17	15	12½	11½	7½	6	4
5¾	68	50	46	38	34	27	25	18	17	13½	13	8½	6½	4
6	75	54	50	42	38	30	28	20	19	15	14	9	7	4½
6¼	81	58	54	46	40	32	29	22	20	16	15	10	7½	5
6½	87	62	58	50	44	35	[illegible]	23	22	17½	16	11	8	5½
6¾	94	67	63	54	47	38	34	25	24	19	17	12	8½	–
7	101	72	68	58	51	40	37	27	25	20	18	12½	9	6
7¼	109	78	73	62	54	44	39	29	27	[illegible]	[illegible]	13½	10	6½
7½	117	83	78	64	58	47	42	31	29	24	21	14½	10½	7
7¾	124	90	83	71	62	50	45	33	31	25	22	15½	11	7½
8	132	96	88	76	68	52	48	36	32	28	24	16	12	8
8¼	141	100	94	80	71	56	51	37	35	29	25	17½	12½	8½
8½	150	104	100	84	76	60	56	40	38	30	27	19	13½	9
8¾	156	111	104	89	78	63	57	42	39	32	29	20	14	10
9	168	120	112	96	84	67	61	45	42	34	31	21	15	10½
9¼	180	127	116	101	90	71	65	47	45	35	32	22	16	11
9½	190	133	125	107	95	75	68	50	47	37	34	24	17	12
9¾	197	141	[illegible]	113	99	79	72	52	50	39	36	25	18	12½
10	208	148	140	120	104	83	75	55	52	42	38	26	19	13

If sharp focus is secured on any of the distances shown, then, with the stop indicated, all objects are in focus from half the distance focussed on up to infinity.

FOCAL LENGTH OF LENSES RECOMMENDED FOR STUDIOS OF VARIOUS LENGTHS.

The following table shows the focus of lens which is suitable for comfortable working in studios of various lengths In each case it is assumed that 5 ft. of the length will be taken up by camera, operator, sitter and background. The figures in column 1 are the full run of the studio, including this 5 ft. In the case of the short studios the focal lengths are about the longest which can be used: in the case of the longer studios somewhat greater focal lengths might be used, but the lenses directed in the table are about the best for general work.

Length of Studio. Feet.	C D V. full length. Inches.	C D V. half length and Cabinet full length Inches.	C.D V. head, Cabinet half length. Inches	Cabinet head and Boudoir full length Inches	Boudoir half length, Panel full length. Inches.	Boudoir head, Panel half length. Inches.
12	4*	6½*	8½	9*	12*	14
14	4¾*	7½*	9	10*	13*	16
16	5¾	8½	10	10½	16	18
18	6	8½	10½	10½	16	18
20	6	10	10½	12	18	20
22	7	10½	12	14	22	22
24	8½	12	14	16	24	24
28	8½	13½	16	16	24	24
30	10	13½	16	18	24	24

* Full lengths may be obtained with these focal lengths, but the standpoint is so near to the sitter that good perspective cannot be expected.

TABLE OF DISTANCES FOR AN OBJECT OF SIXTY-EIGHT INCHES HEIGHT.

COMPUTED BY P. BROSIG.

EQUIVALENT FOCUS (INCHES).	HEIGHTS OF IMAGES (INCHES).																
	1	2	3	4	6	8	10	12	14	16	20	24	28	32	40	48	56	68
2	138·0 2·0	70·0 2·1	47·3 2·1	36·0 2·1														
3	207·0 3·0	105·0 3·1	71·0 3·1	54·0 3·2	37·0 3·3													
4	276·0 4·1	140·0 4·1	94·7 4·2	72·0 4·2	49·3 4·4	38·0 4·5												
5	345·0 5·1	175·0 5·1	118·3 5·2	90·0 5·3	61·7 5·4	47·5 5·6	39·0 5·7											
6	414·0 6·1	210·0 6·2	142·0 6·3	108·0 6·4	74·0 6·5	57·0 6·7	46·8 6·9	40·0 7·1	35·1 7·2									
7	483·0 7·0	245·0 7·1	165·7 7·3	126·0 7·4	86·3 7·6	66·5 7·8	54·6 8·0	46·7 8·2	41·0 8·4	36·7 8·6								
8	552·0 8·1	280·0 8·2	189·3 8·4	144·0 8·5	98·7 8·7	76·0 8·9	62·4 9·2	53·3 9·4	46·9 9·6	42·0 9·9	35·2 10·4							
9	621·0 9·1	315·0 9·3	213·0 9·4	162·0 9·5	111·0 9·8	85·5 10·1	70·2 10·3	60·0 10·6	52·7 10·9	47·2 11·1	39·6 11·6							
10	690·0 10·1	350·0 10·3	236·7 10·4	180·0 10·6	123·3 10·9	95·0 11·2	78·0 11·5	66·7 11·8	58·6 12·1	52·5 12·4	44·0 12·9	38·3 13·5	34·3 14·1					
11	759·0 11·2	385·0 11·3	260·3 11·5	198·0 11·6	135·7 12·0	104·5 12·3	85·8 12·6	73·3 12·9	64·4 13·3	57·7 13·6	48·4 14·2	42·2 14·9	37·7 15·5	34·4 16·2				
12	828·0 12·2	420·0 12·4	284·0 12·5	216·0 12·7	148·0 13·1	114·0 13·4	93·6 13·8	80·0 14·1	70·3 14·5	63·0 14·8	52·8 15·5	46·0 16·2	41·1 16·9	37·5 17·6				
13	897·0 13·2	455·0 13·4	307·7 13·6	234·0 13·8	160·3 14·1	123·5 14·5	101·4 14·9	86·7 15·3	76·1 15·7	68·2 16·1	57·2 16·8	49·8 17·6	44·6 18·4	40·6 19·1	35·1 20·6			

Values are omitted here on account of the wide angle of space required. (More than ninety degrees.)

14	996·0 14·2	490·0 14·4	331·3 14·6	252·0 14·8	172·7 15·2	133·0 15·6	109·2 16·1	93·3 16·5	82·0 16·9	73·5 17·3	61·6 18·0	53·7 18·9	48·0 19·8	43·7 20·6	37·8 22·2			
16	1104 16·2	560·0 16·5	378·7 16·7	288·0 16·9	197·3 17·4	152·0 17·9	124·8 18·4	106·7 18·8	93·7 19·3	84·0 19·8	70·4 20·7	61·3 21·6	54·9 22·6	50·0 23·5	43·2 25·4	38·7 27·3	35·4 29·2	
18	1242 18·3	630·0 18·5	426·0 18·8	324·0 19·1	222·0 19·6	171·0 20·1	140·4 20·6	120·0 21·2	105·4 21·7	94·5 22·2	79·2 23·3	69·0 24·4	61·7 25·4	56·2 26·5	48·6 28·6	43·5 30·7	39·9 32·8	36·0 36·0
20	1380 20·3	700·0 20·6	473·3 20·9	360·0 21·2	246·7 21·8	199·0 22·4	156·0 22·9	133·3 23·5	117·1 24·1	105·0 24·7	88·0 25·9	76·7 27·1	68·6 28·2	62·5 29·4	54·0 31·8	48·3 34·1	44·3 36·5	40·0 40·0
22	1518 22·3	770·0 22·6	520·7 23·0	396·0 23·3	271·3 23·9	209·0 24·6	171·6 25·2	146·7 25·9	128·9 26·5	115·5 27·2	96·8 28·5	84·3 29·8	75·4 31·1	68·7 32·4	59·4 35·9	53·2 37·6	48·7 40·1	44·0 44·0
24	1656 24·4	840·0 24·7	568·0 25·1	432·0 25·4	296·0 26·1	228·0 26·8	187·2 27·5	160·0 28·2	140·6 28·9	126·0 29·6	105·6 31·1	92·0 32·5	82·3 33·9	75·0 35·3	64·8 38·1	58·0 40·9	53·1 43·8	48·0 48·0
26	1794 26·4	910·0 26·8	615·3 27·1	468·0 27·5	320·6 28·3	247·0 29·0	202·8 29·8	173·3 30·6	152·3 31·3	136·5 32·1	114·4 33·6	99·7 35·2	89·1 36·7	81·2 38·2	70·2 41·3	62·8 44·4	57·6 47·4	52·0 52·0
28	1932 28·4	980·0 28·8	662·7 29·2	504·0 29·6	345·3 30·5	266·0 31·3	218·4 32·1	186·7 32·9	164·0 33·8	147·0 34·6	123·2 36·2	107·3 37·9	96·0 39·5	87·5 41·2	75·6 44·5	67·7 47·8	62·0 51·1	56·0 56·0
32	2208 32·5	1120 32·9	757·3 33·4	576·0 33·9	394·7 34·8	304·0 35·8	249·6 36·7	213·3 37·6	187·4 38·6	168·0 39·5	140·8 41·4	122·7 43·3	109·7 45·2	100·0 47·1	86·4 50·8	77·3 54·6	70·9 58·4	64·0 64·0
36	2484 36·5	1260 37·1	852·0 37·6	648·0 38·1	444·0 39·2	342·0 40·2	280·8 41·3	240·0 42·4	210·9 43·4	189·0 44·5	158·4 46·5	138·0 48·7	123·4 50·8	112·5 52·9	97·2 57·2	87·0 61·4	79·7 65·6	72·0 72·0
44	3036 44·6	1540 45·3	1041 45·9	792·0 46·7	542·7 47·9	418·0 49·2	343·2 50·5	293·3 51·8	257·7 53·1	231·0 54·3	193·6 56·9	168·7 59·6	150·9 62·1	137·5 64·7	118·8 69·9	106·3 75·1	97·4 80·2	88·0 88·0
52	3588 52·8	1820 53·5	1231 54·3	936·0 55·1	641·3 56·6	494·0 58·1	405·6 59·6	346·7 61·2	304·6 62·7	273·0 64·2	228·8 67·3	199·3 70·4	178·3 73·4	162·5 76·5	140·4 82·6	125·7 88·7	115·1 94·8	104·0 104·0

This table gives, in inches, the distances from lens to object (greater conjugate focus, upper number) and from lens to ground glass (lesser conjugate focus, lower number) for different heights of images and different lengths of foci of lenses, when the height of object is 68 inches (=average height of man).

EXAMPLES.

Q.—What is the height of image of a person who is 133 inches distance from lens, when a lens of 14 inches focus is used?

A.—The height of image in this case is 8 inches.

Q.—What are the distances between object, lens, and ground glass if the image of a person is to be 8 inches high and a 14 inches focus lens is employed?

A.—The distance from object to lens will be 133 inches, and from lens to ground glass 15·6 inches.

TABLES IN PAST ISSUES OF THE ALMANAC.

The following is a list of tables which have appeared in past issues of the "Almanac," but are not included among those in the present volume.

The reference in brackets after each is to the most recent issue of the "Almanac" in which the table has appeared; in most cases it will be found included for several years prior to the date of this reference.

Chemical Tables.

Weights and Measures Act. ["B.J.A." 1905, p. 1012.]

Simplification of Emulsion Calculations. (Equivalence of Alkaline Haloid Salts.) ["B.J.A." 1903, p. 1160.]

Solubility of the Silver Haloids—Valenta. ["B.J.A." 1907, p. 1109.]

Freezing Mixtures. ["B.J A." 1907, p. 1116.]

Chemical Equivalence of the Alkalies. ["B J A." 1903, p. 1159.]

Developing Equivalence of the Alkalies. ["B.J.A." 1903, p 1159]

Chemical Reactions of the known Developing Agents (Tests of Developers). ["B.J A." 1904, p. 1010.]

Pyro Developers recommended for various Plates by Makers. ["B.J.A." 1890, p. 666]

Tables of Developers (in grains per oz) for Various Commercial Plates ["B.J.A." 1912, p. 761.]

Orthochromatic Data.

Speeds and Colour Sensitiveness of Various Plates to Different Lights.—Eder. ["B.J.A." 1907, p. 1115.]

Wave-Lengths of the Principal Fraunhofer Spectrum Lines, and the Elements that give them ["B.J.A." 1905, p. 1144.]

Reflection of Light from various surfaces. ["B.J.A." 1900, p. 1016.]

Light and Exposure.

Hourly Variation in the Sun's Position in Degrees from the South at Different Seasons of the Year.—J. A. C Branfil. ["B.J A." 1903, p. 1176.]

Points of the Compass at which the Sun rises for London, Edinburgh, and Dublin. ["B.J.A." 1869, p. 147.]

Sun's Altitude for various Latitudes. ["B.J.A." 1898, p. 1068]

Exposure and Lens Aperture. ["B J.A." 1910, p. 894]

Actinograph Exposure Table. ["B.J.A." 1901, p. 702.]

Comparative Exposures.—W. K. Burton ["B.J A." 1887, p. 341]

Comparative Exposures.—Dr. Scott. ["B J.A." 1887, p. 432]

Displacement on Ground Glass of Objects in Motion. ["B.J.A." 1903, p. 1180.]

Comparative Plate-speed Numbers. ["B.J.A." 1912, p. 897.]

Optical Tables.

Equations relating to Foci, etc —Branfil. ["B.J A." 1907, p. 1120.]

Depth of Field.—Formulæ. ["B.J A." 1910, p 894.]

Combining Lenses.—Formulæ. ["B.J.A." 1910, p. 893.]

Perspective—Factors. ["B.J A." 1910, p. 895.]

Correction of Convergent Distortion.—Formulæ. ["B J.A." 1910, p. 896.]

Scale of Image.—Formulæ. ["B.J A." 1910, p. 893]

Conjugate Foci.—Formulæ. ["B.J A." 1910, p. 892.]

Minimum Length of Studio for a given Lens. ["B.J.A." 1905, p. 998.]

Royal Photographic Society's Standard Diaphragms. ["B.J.A." 1903, p. 1178; 1905, p. 1149; and 1907, p. 1093]

"Uniform System" Numbers for Stops from f/1 to f/100. ["B.J.A." 1905, p. 1147.]

Continental Stops and their U.S. Equivalents. ["B.J.A." 1907, p. 1127.]

Correction for Inconstancy of Aperture—Formulæ. ["B.J.A." 1910, p 895]

Angles and Foci of the Telephoto Lens. ["B.J.A." 1894, p. 949.]

Steinheil's Table of Camera Extensions, Equivalent Foci and Diameters of Images corresponding to a given Magnification of the Telephotographic Lens. ["B.J.A." 1902, p. 782.]

Focussing with Pinhole Apertures. ["B.J.A." 1896, p. 954.]